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Automotive Industries Advertising Manager
Cable Address ..... Autoland, Philadelphia
Telephone ..... Sherwood 1424

OFFICES

New York—U. P. C. Bldg., 239 W. 39th St., Phone Pennsylvania 6-0080
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AUTOMOTIVE INDUSTRIES

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"Protect Inalienable Rights of Highway Users"

Transport agencies must provide service which public wants. Nothing can be gained by arbitrary restrictions on future growth

by Roy D. Chapin

IF the railroads are unduly penalized today by regulation imposed in an era of monopoly, then the laws should be modernized.

This done, it is the obligation of the transportation agency to provide, as it is the shipper's right to insist on, that service which the public wants.

All other issues aside, I know of no formal mandate which can force a consumer to buy that which he does not want.

We want our railroads to prosper in order that they may render effective service. They could not prosper if, in any effort to help them we cut off the complementary services of truck, bus

THE Secretary of Commerce last week stated forcefully his attitude on the broad problems of transportation taxation, regulation and restriction which are certain to be fought out in 44 state legislatures next year as well as in Congress at Washington.

Here are excerpts from what he said and a few comments on allied topics he made to the American Association of State Highway Officials in Washington, Nov. 16.

Coming as it does on the eve of a legislative year fraught with uncertainty and danger for automotive interests, Mr. Chapin's pronouncements are of major importance.

Don't fail to read them!

and private automobile, with all that the production, sale and use of these private fleets means to railroads as well as to labor, agriculture and industry.

The whole story of transportation in this country is a fascinating study in evolution. Step by step, research and mechanical genius have changed the form of our vehicles, each time expanding the service which they can render to the public.

How far the next quarter of a century will carry us no man living now can say, but we do know that our development is as yet but begun.

We shall gain nothing if we seek arbitrarily to limit and restrict these developments. Rather, our policy must be one of enabling each agency to fit into that place in the transportation service which it can fill most economically and most efficiently.

Safeguard the Rights of Highway Users

The man who uses the highway has certain inalienable rights which should be safeguarded.

First, he has the right to demand that the legislator shall not single out his vehicle as a tax medium for the payment of general taxes.

Second, the road user has a right to insist of the tax-collecting agencies that the special taxes which he has paid for highway use shall be conserved solely for that use.

There is no justification for the diversion of these sums to other purposes, however worthy they may be in themselves.

Third, in times like the present, particularly, he has a right to demand a thorough review of his tax rates. Taxes imposed on the values of 1928 and 1929 fall heavily upon people with the incomes of 1931 and 1932. In thousands of cases the records show declining motor registration and declining use due to heavy costs.

When tax rates become oppressive they stifle initiative and employment.

This is a matter of large moment when the main objective of all of us is to get men back into productive work.

Even if we could ignore that larger issue, we can not escape the fact that unduly high rates automatically reduce the tax returns.

Taxes and Incomes Must Balance

Taxes, like other costs, must be brought into balance with depleted incomes.

If I could make one suggestion of the direction a spending review might take, it would be to observe that the *administration should be centralized in the state highway departments as much as possible.*

We shall thereby have more funds for the development of those local roads which are the key to the modern farmer's existence.

Independent sub-divisions were an essential when travel was limited to horse and wagon. We have passed that era.

Fourth, among the rights of the road user is the opportunity for as full and unrestricted use of the highway as he can make, once he has met his obligations.

The highway and the vehicle belong to the people. Together they are peculiarly the public's own transportation.

Once such physical regulation has been imposed as is necessary in the public interest, then a minimum of restriction should be enacted.

There should be complete reciprocity between the states and the regulations should be uniform. Otherwise, not only the rights of the individual are infringed upon, but society as a whole must bear the penalty of the higher costs which inevitably are a part of regulation.

It is hardly necessary to add that safety requires all possible simplification and standardization of the rules of the road. In this connection, the qualified driver has a right to insist that the state shall give him the protection of ruling out the incompetent and unfit.

As I see the obligations of the road users, they can be set forth in two sentences:

1. Each should pay his fair share of the cost of the development.

2. Each should use the road with due regard for the safety of all others on the highway.

Without interstate highways, interstate commerce could not be fully served. Our postal services could not be completely rounded out. National defense would suffer in times of emergency, as I vividly recall it did during the World War.

Neither states nor communities could be bound so closely together.

So the Federal, like state and local governments, has a distinct and continuing obligation in highway development. This it is meeting in part, at least, by a wise policy of Federal highway appropriations.

A second and more special interest is that of the automobile vehicle owners.

Just as the Federal Government recognized its responsibility, so, as I happen to know, the users recognized theirs, years ago when they voluntarily asked for taxation of themselves in order that they might have roads.

Highway Taxes Must Be Levied Equitably

If, as time has gone by, there have been developed different types and uses of vehicles, so that the payments may vary, the principle still obtains that they, too, should pay their fair share of the costs.

Third, there are those who do not live immediately adjacent to a highway of general use but who still must have some means of getting to one.

Their problem is one of the most difficult phases of highway taxation. The farmer, like other land holders, is suffering from heavy taxes. Further, in the past he sometimes has paid more than his fair share of highway costs.

The fairest solution seems to rest in the policies which the states are now pursuing. Annually a large mileage of roads of general motoring use is being taken over by the states and paid for out of motor vehicle and federal funds. In many cases, too, county bond issues are being amortized in the same way.

As this is done, local funds are released for local roads which, fortunately, will not require so much improvement because they will not have to carry much traffic.

If there is any single criticism which can be made of our methods of highway finance, it is that we have too often tried to meet capital costs on a current basis.

The motorists can no more do this than could the railroads in their period of development. Capital expenditures must be spread out. Gradually this is being done.

There are other group interests in highways which could be defined, but, by example, the financial obligations have at least been outlined.

A news article about the major developments which took place at the American Association of State Highway Officials appears on page 695, this issue.

Welded Aircraft Structures Discussed at Annual Meeting

A MOST successful annual meeting, its thirty-third, was held by the International Acetylene Association at the Penn Athletic Club, Philadelphia, Nov. 16, 17, and 18. Two sessions were held each day. By far the most extensive use of acetylene today is in the welding and cutting of metals, and all of the papers dealt with applications of these processes in different lines of industry, the testing of welds, and economic phases of the welding process.

At the business session which concluded the meeting, new by-laws were adopted and officers were elected for the coming year. E. J. Hayden, Linde Air Products Co., Chicago, was elected president; G. B. Walker, Linde Air Products Co., New York, vice-president; W. E. Cotter, New York, treasurer, and H. F. Reinhard, New York, secretary.

The Morehead medal, which was established in 1922 by John Motley Morehead in honor of his father, the late James Turner Morehead, was awarded to Gustaf Dalen of Stockholm, Sweden, for his invention of the acetylene light flashing device used on marine buoys and beacons, and of the sunlight valve, which shuts off the supply of gas to beacons, etc., during day time. These inventions date back to the early years of acetylene lighting and they had the effect of establishing the acetylene lamp firmly in marine lighting. For the two inventions mentioned Mr. Dalen previously had been awarded the Nobel prize. It is expected that the prize will be officially presented to the inventor at next year's annual meeting, which will be held in Chicago Sept. 26-29.

From the automotive standpoint, the session on Thursday afternoon, devoted to papers on the use of the oxy-acetylene welding and cutting processes in the transportation industries, was of greatest interest. The first speaker of the session was Capt. Alford J. Williams, Jr., U. S. Navy, retired, the well-known speed pilot. Capt. Williams referred only briefly to the use of welding in the fabrication of airplanes, by outlining the progress from the old "wooden ships" to the modern all-metal types, and then related incidents from his wide and variegated experience in the air, particularly in connection with the development of the technique of upside-down flying.

Welding in the construction of naval aircraft was covered in a paper by Lieutenant E. W. Cloxton, shop superintendent of the Naval Aircraft Factory in Philadelphia. Lieutenant Cloxton said the problem of welding was attacked by the entire aircraft industry almost simultaneously, and there had been a very free interchange of information within the group. The Naval Aircraft Factory had taken its share in the development; it had drawn freely upon the experiences of others, and had just as freely made available to others the results obtained by it. Following are some extracts from the paper:

"One of the first and most serious restrictions placed upon the use of welds in aircraft structures was the prohibition against placing any reliance upon welds in direct tension. This prevented plain butt-welds of tubing, and led to diagonal and serrated sections, with the result that the fish-mouth weld is now regarded as standard. In building up fittings and in joining tubing to fittings, liberal use of gusset plates, much in excess of what would otherwise have been required, was demanded. These gusset plates must be so devised that the line of welding lies in or parallel to the line of action of the forces, rather than parallel to it.

Morehead medal awarded to Gustaf Dalen of Stockholm

"Although butt-welds are taboo for carrying loads in aircraft structures, the problem of making satisfactory butt-welds cannot, on that account, be sidestepped, as it is necessary that tubular structures be completely sealed in order to exclude moisture. This is a measure of protection against deterioration that has been found to be absolutely essential for Naval aircraft in service conditions of exposure to salt water and salt air.

(Turn to page 697, please)

JUST AMONG

WE'RE going to make Harry Horning involuntary guest conductor of this page this week. He talked so entertainingly on the driest of all subjects, "Research," to the student meeting held by the Metropolitan Section of the S.A.E. a month or so ago that we want everybody to get the benefit.

If we have failed to pick out of his talk the points which were the most important, we crave indulgence. Our aim has been simply to pick out the sentences and paragraphs out of which we got the biggest kick.

For those few who don't know Mr. Horning, we hasten to identify him as president of Waukesha Motor Co., a former president of the Society of Automotive Engineers and one of the leading members of that small group which can claim high success both as scientists and business executives. So here goes! Harry L. Horning speaking:

* * * *

Harry L. Horning Says . . . .

"Research is just common sense gone high-brow.

"Thinking is the rarest and most difficult act of the human mind. With most men, when they have constructive thought, their faces light up, and they become so excited and finally so exhausted that they are unfit for thought for another year or so."

* * * *

Research Leads to the Unsuspected

IN starting a research, there are always certain ends in view. The direct results are, of course, the primary consideration, and it is the value of these which justifies the appropriations of time and expenditure.

The most important factors to which your attention is called are the indirect results; collateral discoveries, influence, or by-products, and they are in a majority of cases of equal importance, and in many cases of greater importance than the primary objectives.

Columbus was a great research man. When acting on the inspiration with which Marco Polo inflamed his imagination and the theory of a spherical earth, he started out to find the East Indies for their spices. He discovered a new world, but its gold and continents were of vastly greater importance than the East Indian spices.

When Roentgen discovered the X-ray, it was a by-product of another quest, and this has led to the discovery of radium, better understanding of matter, has destroyed the atomic theory and substituted the speculative realm of electrons, protons, photons, neutrons and explained the photo-electric phenomena, and revealed the strongest assumptions on which the quantum theory rests. It cast light on the mechanism of chemical reactions, and physical causes, and in the end, made chemistry, physics, biology and all related sciences one and inseparable, and came to the supreme conception of our physical world in the Einstein Theory.

Experience Teaches Peculiar Things

EXPERIENCE has taught that several peculiar things happen during every research project, and one will be sure to run into them.

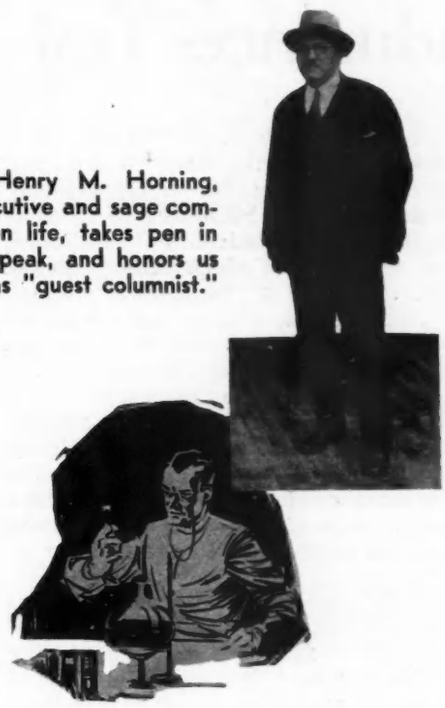
1. A general hesitation in getting under way. This is the period of gathering facts, and corresponds to the homing pigeon's circular flights of orientation.
2. The tendency to go off on a tangent, or become interested in a by-product of the research. It is always hard to keep the research train on the track.
3. The tendency to delay the finish. It seems that bringing a research problem to a conclusion is the most difficult part of the task, and the most value of research is lost at this time.
4. The psychological collapse when the thing is done, for everyone loses interest in it, and there is a great delay in following through to the application of an idea.
5. The skepticism of the practical man toward the results of a research.
6. The usual difficulty to get the market and world in general to adopt the results of research.

* * * *

Research That's Not Research

THERE is some common misunderstanding on what is research, for most research, as discussed in our magazines and trade papers, in fact that which is proclaimed in the loudest voices, is really industrial devel-

OURSELVES



—in which Henry M. Horning, engineer, executive and sage commentator upon life, takes pen in hand, so to speak, and honors us involuntarily as "guest columnist." —N. G. S.

opment. I like to make the distinctions as follows:

1. Pure research is to attain facts on any situation with no specific application in view, and for the sake of the knowledge itself.
2. Applied research is to find the best way of meeting a class of specific problems.
3. Industrial development is an effort to apply the results of pure and applied research to a specific problem for useful gain.

* * * *

It's Thinking That Does It

NOT many years ago a company in the automotive industry came to a dead center. The president got wise that something called "research" was sadly missing and that was why one of the units in the industry was prospering. He ordered a proving ground and a laboratory. When the laboratory equipment was presented to him for his approval, he glanced at the appropriation, swept it aside with a grand gesture, and said, "Double it."

His idea that doubling the laboratory equipment would double the value of the laboratory product is really one of great misconceptions. I believe after trying it both ways, with little and much equipment; that *the value of the work done varies inversely with the value of the equipment.* This should not be so but it accents the value of the mind with just a little help in apparatus. American laboratories are overgrown. It seems to me that we Americans lose sight of the problem in our maize of equipment. It is a great delight to see many foreign laboratories and to realize the results they get from their meager apparatus. Results depend more on mental equipment than they do on physical apparatus, and there is nothing so rare as a man with a research mind.

* * * *

Sound Answers Under Dirty Hats

DON'T depend too much on high-brow scientists. Keep your ear open to the man in the shop and on the road. The answer to a research problem isn't particular where it lurks, and often hides under the dirtiest hats.

Good Hunters Get the Game

RESEARCH is hunting in its essence. The first research man was a hunter, who rather than be discouraged because he found no game, the first or the twentieth time in going through a woods, stalks through in another way.

In hunting there is a well-known rule: Do not look too intently for the object of the hunt. Let the eyes be at ease and rove carelessly and slowly and not too sharply over the woods. You are much more likely to cover the ground more thoroughly than by giving the attention to one object. Don't stare—browse! This applies to the initial stages of research when facts are being gathered. The time to stare is when you have the facts.

Alloys Superior to Carbon Steel in Endurance Test of Valve Springs

by P. M. HELDT

ONE of the greatest sources of weakness in high-speed engines is the valve springs. Not only must these springs be very strong relative to their permissible bulk, but owing to the high frequency of the impulses to which they are subjected, a surging action often occurs which causes stresses far greater than those due to the normal working cycle. Surging often leads to failure, and the breaks occur, as a rule, about one convolution from the end of the spring. The resulting fractures usually show all of the characteristics of fatigue failures.

A systematic investigation of valve-spring failures was made some years ago at the Royal Aircraft Establishment in Farnborough, England. To study the surging action, a stroboscopic device was built which permitted of observing the motion of the convolutions relative to each other at a reduced speed and on an enlarged scale.

Surging occurs particularly at definite engine speeds which are dependent on the dimensions of the springs. Each spring has a natural rate of vibration depending upon its weight and its "rate," that is, the number of pounds pressure required to compress it one inch. Surging occurs when the frequency of impulses received by the spring is equal to the natural frequency of the spring. While it might be thought that the spring received an impulse every time the valve was lifted by the cam, actually this major impulse has an endless series of harmonics, and it is usually one of the higher harmonics (between the tenth and the fifteenth) that causes troublesome surging in valve springs of automotive engines. Each one of these harmonics can cause surging, though the amplitudes of the harmonics are different, and some may be so small that the surging is hardly noticeable. The "critical" speeds of the engine at which surging is pronounced are therefore quite close together; for instance, that due to the fourteenth harmonic is only about 7 per cent lower than that due to the thirteenth harmonic. Moreover, the springs of the different valves are never perfectly alike in their dimensions, in consequence of which their natural rates of vibration also are somewhat different, and usually one or more springs surge at practically all speeds within the higher range.

The mechanism of spring surge may be visualized as follows: When one end of a coiled spring is subjected to a gradual increase in pressure, its individual coils will close up uniformly, because the elastic resistance to compression is the same throughout its whole length. But when the free end of the spring is dealt a sudden blow, an additional force, the inertia of the spring material, comes into play. The inertia force on any small element of the spring is equal to the product of the mass of that element into its acceleration. The rate of acceleration naturally varies from end to end, being a maximum at the free end and zero at the stationary end.

The inertia force, moreover, is cumulative; that is to say, the inertia on the whole mass of the spring opposes the motion of the free end. As a matter of fact, the motion of the free end is not affected, since the cam motion is positive, or at least very nearly so; but the motion of the individual coils of the spring is affected. For instance, the first coil at the free end is subjected to compressive force resulting from the elastic force of the spring and from the inertia force on all of the coils above it; the next coil is subjected to the same elastic force and to the inertia force on one less coil and so on. It is therefore obvious that while the free end of the spring is being accelerated by the cam, the lowest coil will compress most and each succeeding coil will compress less.

When acceleration due to cam action stops, the individual coils of the spring are therefore non-uniformly compressed, the lowest coils being compressed most and the uppermost coils least. The

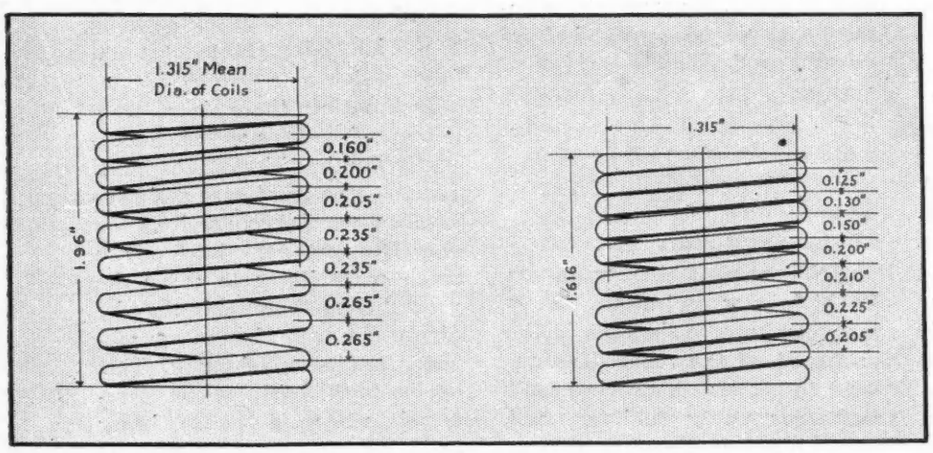


Fig. 1—Surging outer spring of valve

The surge passes through a dozen or more complete cycles per revolution of the camshaft and the view on the left shows the wave at the top when the tappet is on the base circle of the cam, while the view on the right shows the wave at the top when the tappet is on top of the cam lobe. The speed is 1006 r.p.m.

Fractures from surging generally occur about one convolution from the end and show all of the characteristics of fatigue failure. Definite engine speeds, dependent upon the dimensions of the springs, produce surging

natural result is an equalization of the compressions, the lowest coils expanding and the uppermost coils closing up more. Thus the point of maximum compression travels from the bottom of the spring toward the top. As a matter of fact, this equalization of "compressions" starts even before acceleration of the free end ceases, for when the acceleration becomes quite small, its effect is overpowered by the tendency of the coils to equalize themselves.

From the top or stationary end of the spring the wave of compression is reflected, and the point of maximum compression travels downward. When it arrives at the free end, a cycle of the periodic force which induces the surge has been completed, and the point of maximum compression starts upward once more.

The stress in the wire of coiled springs varies directly with the amount of closing up of the coils from the free state. Therefore, if a coil closes up more than normally, it is subjected to increased stress. When there is surge, not only do the coils come closer together than they do otherwise, but they also separate farther. The stresses are still in the same direction, since the coils never separate so far that the initial stress is entirely removed, but the minimum stress is lower than it is at any time without surge, and the maximum stress being higher, the stress range is much greater. This is an important factor in causing fatigue failure. As regards the changes in the maximum stress and in the stress range due to surging, in a paper read before the Institution of Mechanical Engineers (England) some time ago, by A. Swan, H. Sutton, and W. D. Douglas, a particular case was cited in which the stress range was increased from 18,000-47,400 to 6,700-70,000 lb. p. sq. in.

One way of minimizing surge consists in so spacing the convolutions at the free end of the spring that they close up completely under the pressure exerted by the cam when applied slowly. It is the end convolution that is affected most by the inertia, since it is subjected to the force of inertia of all the remaining convolutions. The extra closing movement due to inertia is less in the second convolution and still less in the third. Thus by graduating the spacing of the convolutions according to their distance from the free end, trouble from surge can be practically eliminated. The method has the disadvantage that the inertia is a function of the speed, and if the springs were so designed that the end coils closed up completely at the normal working speed, then at any higher speed they would come together with a shock, and the springs would be noisy.

Another preventative consists in the application of

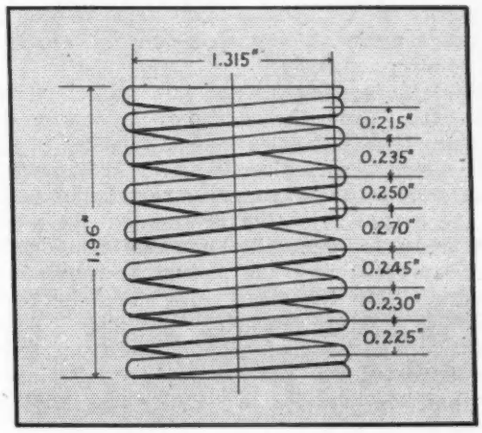


Fig. 2—This view shows the spring vibrating about three nodes (top, bottom and center).

Waves start simultaneously from both ends and meet at the center, so that the absolute motion of the center point is not affected. This diagram corresponds to 946 r.p.m.

a damper. This consists in a frictional device which bears lightly against the center coils. It is the center coil whose absolute motion is most affected by surge, since the top end always remains stationary and the bottom end follows the cam outline whether there is surge or not. A little frictional damping of the center coil therefore effectively checks the surge. Such valve-spring dampers are being used on Studebaker engines. Most designers seem to prefer to deal with the problem of surge by making changes in the proportions of the springs, thereby avoiding the need for additional parts.

Since the failure of valve springs results usually from fatigue, the fatigue resistance or endurance limit is one of the most important characteristics of spring wire, and fatigue tests on six different grades of spring steel were made at the Royal Aircraft Establishment. These included low-carbon steel (L.C.), high-carbon steel (H.C.), silico-manganese steel (S.M.), cold-drawn carbon steel (C.D.C.), chrome-vanadium steel specially prepared (C.V.A.), and Swedish steel wire (G 16). The wires were supplied in coil form and were all of No. 8 I.W.G. gage (0.160 in. diameter), except the C.V.A., which was of No. 10 gage (0.128 in. diameter). The first three grades were of commercial quality, while the last three were specially supplied for use in valve springs of aircraft engines and were known to

be of high quality. The compositions of all of the steels were determined by tests. Since the wires were received in rolls, it was necessary to straighten them, and machine-straightening by drawing between three rollers proved to give the best results and was used for all of the wires.

The wires were hardened by heating in an electric furnace, quenched in oil (with certain exceptions) and were then tempered by immersing in a salt bath for about 15 minutes and cooling in water. After being heat-treated, the wires were carefully examined for cracks. Where cracks were suspected but could not be readily discerned, the following treatment was applied: After anodic cleaning in a solution of sodium carbonate at a current density of 10 amperes per square foot, the wires were immersed in an ammonium-chloride solution overnight, then wiped, and allowed to stand for a further period of 12 hours; the presence of cracks was shown by fine rust streaks. No fatigue tests were made on any specimens in which cracks could be seen definitely.

Both static tensile tests and torsion tests were made on all wires. From the results of the torsion test the maximum stress was calculated as follows: (1) assuming the stress to vary directly as the distance from the axis of twist, the maximum stress being calculated from the torque necessary to fracture the wire completely, and being generally known as "torsional modulus of rupture"; and (2) assuming constant stress from core to skin, the stress being calculated on torque required to fracture the wire completely. As in the tensile test, the limit of proportionality of the wires not heat-treated was too low to be determined accurately, and the modulus of rigidity was uncertain in these cases.

Fluctuating Torsion Test

Resistance to fatigue in torsion was determined by means of a test referred to as a fluctuating torsion test. In this one of the grips of the testing machine was given a rotary oscillation at the rate of 2000 cycles per minute. All stresses applied in this test were estimated from the strains, on the assumption that the relation between stress and strain was the same as in the static torsional test. The range of stress imposed in the fluctuating torsion test was 0.25 to 1.0 expressed in terms of the maximum stress for each cycle.

The low-carbon (L.C.) steel had the following composition: 0.51 C, 0.11 Si, 0.033 S, 0.054 P, 0.67 Mn, and 0.07 Cr. In the condition as received the limiting value of apparent stress range for the average material was about + 16,200 to + 65,000 lb. p. sq. in. A few specimens failed after a short life, suggesting a limiting value of stress range as low as 14,600-58,200 lb. p. sq. in. This material gave fairly uniform results. Although heat treatment improved the static tensile properties, the heat-treated specimens showed no improvement in respect to the results obtained in the fluctuating torsion test. Most of the fractures obtained in the fluctuating torsion test showed a long crack parallel to the axis, with helical cracks meeting it on opposite sides at points 0.2 to 1.0 in. apart. Hardness tests showed some softening of the skin. The microscopical examination showed considerable slag inclusions. The authors of the paper thought it probable that these inclusions caused the formation of minute cracks during the quenching operation and prevented the advantageous use of the natural hardness of the steel.

The ratio of the stress range to the ultimate stress was high, a ratio of this same order having beeh observed in one other material only. This high ratio for the condition of the steel as received was thought to be due to the ductility of the steel preventing detrimental stress accumulations at points where there were physical defects.

The high-carbon (H.C.) steel had the following composition: 0.89 C, 0.075 Si, 0.044 S, 0.038 P, 0.43 Mn, and 0.09 Cr. In the condition as received the limiting value of apparent stress range was about 13,400-53,700 lb. p. sq. in. Failure was associated with longitudinal cracks, which suggested the existence of flaws in the wire. The endurance test results were tolerably uniform; the few premature failures that occurred suggested a limiting stress range of as low as 11,200-44,800 lb. p. sq. in. Oil quenching from 1475 deg. F. and tempering at 825 deg. F. gave unsatisfactory results, and the deleterious effects of this treatment were not appreciably modified by a previous reduction of the diameter by 1 per cent. Longitudinal cracks were noticeable after the heat treatment. Oil quenching from 1360 deg. F. and tempering at 825 deg. F., although it improved the static strength, did not increase the endurance under fluctuating stresses unless the surface of the wire had first been removed. After this heat treatment, some cracks were still to be seen, but after the same treatment applied to wires that were first reduced in diameter by 0.002 in., no cracks were visible.

The fracture normally began as a small longitudinal crack which extended radially inward from the surface for some distance. Secondary cracks formed on opposite sides of the longitudinal fissure, usually some distance apart and spreading at an angle of about 45 deg. to the longitudinal, thus forming helicoidal surfaces of fracture that extended about half-way around the wire, and then usually joining up in a more or less irregular manner. Occasionally there was no longitudinal portion, while in some cases there were several. Hardness measurements showed the hardness to be consistent with the tensile strength, except near the skin, where a reduction in hardness of as much as 15 per cent was observed. The microscopic examination showed slag streaks to be more numerous in this wire than in any other.

Longitudinal Cracks Prevent High Loadings

The endurance tests showed that the effective use of the high mechanical properties usually associated with heat-treated steel of this class is impossible, owing to the tendency to failure due to the longitudinal cracks. The wire, which was of regular commercial quality, had considerable amounts of nonmetallic inclusions. The cracking which occurred when the steel was quenched from the high temperature is thought to be indicative of the inability of the steel to withstand the severe internal stresses due to quenching, and it is thought that minute cracks are formed even when quenching from the lower temperature.

The composition of the silico-manganese (S.M.) steel was as follows: 0.54 C, 1.90 Si, 0.026 S, 0.032 P, 0.99 Mn, and 0.05 Cr.

This steel as received showed a breaking strength in tension of 123,000 lb., while the maximum stress in torsion (calculated on the assumption that the stress varies uniformly with the distance from the axis) was 98,500 lb., and the modulus of torsional rigidity, 11,600,000 lb. p. sq. in. When oil-quenched at 1740

deg. F. and tempered at 790 deg., the breaking strength was 232,000 lb., the maximum stress in torsion, 181,500 lb., and the torsional modulus of rigidity, 11,550,000 lb. p. sq. in. When oil-quenched at 1830 deg. and tempered at 825 deg., the breaking strength in tension was 246,500 lb. After this heat treatment the wire showed a longitudinal crack extending the whole length.

In the condition as received, the limiting stress range for the average material was about 19,000-76,000 lb. p. sq. in. One run of 3,000,000 repetitions of stress was obtained with a stress range of 20,000-80,500 lb. p. sq. in., with fracture at the grip, and one specimen was unbroken after 17 million cycles with a stress range of 18,000-71,800 lb. A considerable number of fractures occurred after short runs at comparatively low values of stress, indicating that this wire as received is unreliable for use at a stress range greater than 11,000-45,000 lb.

After being quenched at 1740 deg. F. and tempered at 760 deg., the wire gave somewhat improved results. The limiting value of apparent stress range was about 19,000-76,000 lb. p. sq. in., but one run of 10,000,000 cycles was obtained at 21,000-85,000 lb. p. sq. in. and only two failures occurred prematurely, one at a flaw in the metal and the other at one of the grips. Quenching at 1830 deg. F. and drawing at 1025 deg. F. seemed to be unsuitable. This wire gave variable results, especially in the condition as received, and heat treatment, although it increased the static strength, did not materially increase the resistance to fatigue.

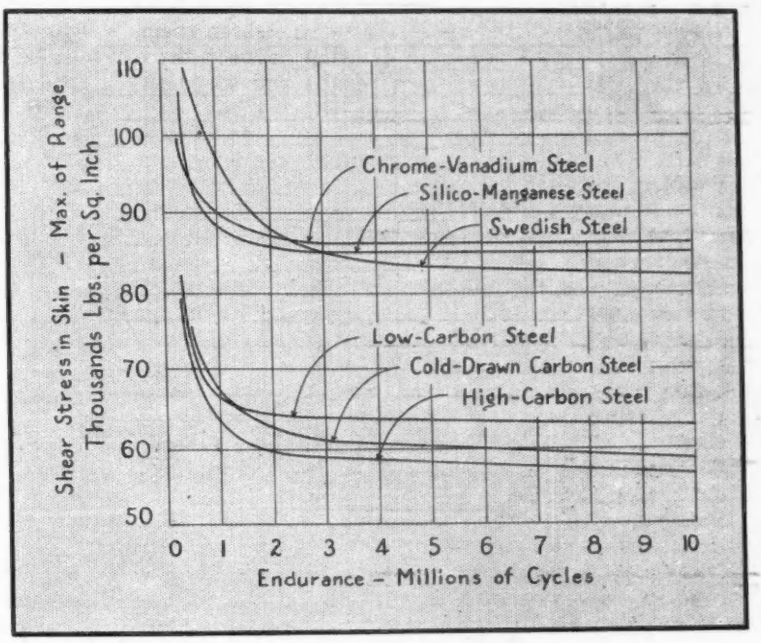


Fig. 3—Endurance characteristics of various spring wires

Chrome-vanadium steel wire of 10 I.W.G., oil-hardened at 1544 deg. F. and tempered at 788 deg. F.—Silico-manganese steel wire of 8 I.W.G., oil hardened at 1742 deg. F. and tempered at 788 deg. F.—Swedish steel wire of No. 10 I.W.G., oil-hardened at 1544 deg. F. and tempered at 788 deg. F.—Low-carbon steel wire of No. 8 I.W.G., as received.—Cold-drawn steel wire of No. 8 I.W.G., as received.—High-carbon steel wire of No. 8 I.W.G., as received. —In all cases the ratio of maximum to minimum stress was 4:1

In the fluctuating torsion test the wire as received showed a marked tendency to form longitudinal cracks. Hardness tests at different depths showed hardnesses consistent with the static strength, except near the skin, where the hardness was reduced by 15 per cent in the case of the wire as received, and as much as 30 per cent after a certain heat treatment. The effect penetrated to a depth of about 0.005 in. Polished and etched sections showed a considerable number of slag inclusions—more than in the cold-worked carbon and the chrome-vanadium steels examined, but less than in the high-carbon steel.

Determinations of surface decarburization were made by grinding off successive layers of 0.005 in. thickness and burning in oxygen. The first, second and third layers were found to have carbon contents of 0.17, 0.45 and 0.54 per cent respectively.

Quenching the silico-manganese wire from moderate temperatures did not always develop serious cracks, but the improvement in the torsional fatigue properties was not commensurate with that of the tensile properties. This wire appeared to have a soft skin due to decarburization.

The specially prepared cold-drawn carbon-steel wire contained 0.71 C, 0.12 Si, 0.01 S, 0.04 P, 0.59 Mn and 0.11 Cr.

Static tests of the steel in the "as received" condition gave a tensile breaking strength of 200,000 lb. p. sq. in. and a torsional breaking strength of 139,000 lb. p. sq. in., the modulus of torsional rigidity being 11,000,000 lb. p. sq. in.

The limiting value for the average stress range was found to be about 15,000-63,000 lb. p. sq. in. A few specimens failed after a short life, suggesting a limiting stress range as low as 13,000-54,000 lb. p. sq. in. These results are not only low in absolute value, but also low with relation to the static strength. The fractures obtained showed a marked tendency toward the longitudinal form of crack, indicating flaws in the direction of the drawing.

Hardness at different depths was consistent with the static properties, except at the surface, where a decrease of 15 per cent was observed, extending to a depth of 0.004 in. As regards freedom from incusions, this wire appeared to be one of the best, and almost as good as the special chrome-vanadium wire. As regards the torsional-fatigue properties of this wire, they were relatively low, but consistent.

The specially prepared chrome-vanadium steel contained 0.53 C, 0.28 Si, 0.020 S, 0.020 P, 0.77 Mn, 1.20 Cr and 0.18 V.

In the "as received" condition this steel showed a tensile strength of 218,000 lb. p. sq. in. and a torsional breaking strength of 163,000 lb. p. sq. in. Its modulus of torsional rigidity was 11,700,000 lb. p. sq. in. No premature failures occurred except when fractures took place at the grips. These fractures suggest a lower limit of the possible value of stress range of 16,750-67,000 lb. p. sq. in. Tests on wires of reduced diameter showed that the core was better from the standpoint of torsional endurance strength than the wire as a whole. The hardness was found to be reduced by about 8 per cent over a depth of 0.003 in. at the skin. Fractures of this wire were of the short type and generally free from indications of longitudinal cracks. On the other hand, the usual straight but short longitudinal step could generally be detected

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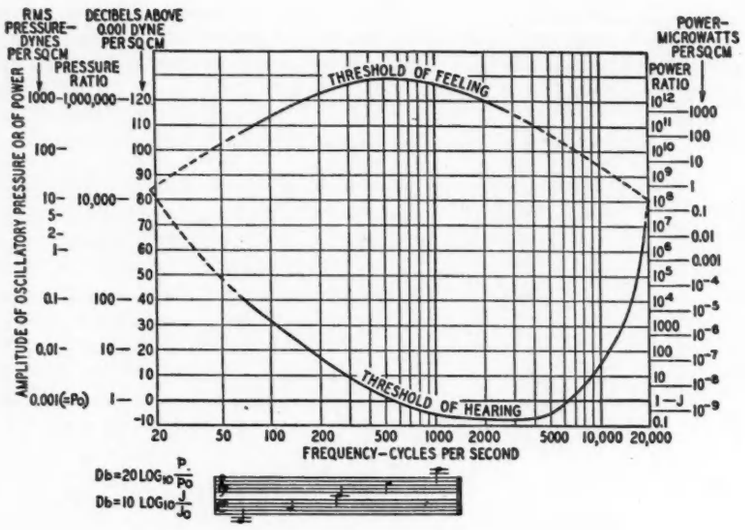


Fig. 1—This represents the range of perception of the human ear. Values are given in loudness units, db, and in corresponding physical units

by Joseph Geschelin

Measurement of Noises Segregated Confusion, Marks Important Step to

This, the first of a series of articles, states the ever-increasing problem and shows how a scientific approach has been made to control the tumult of noises

The second of the series will appear in an early issue and point the way toward building more quietness into the present-day cars

SILENCE is Golden.

This old adage applies to automobiles as well as tongues.

And because of the public's insistence upon a certain level of performance, automobile makers and their suppliers have wrestled with the problems of noise abatement for these many years. Needless to say, much progress already has been made. But there is still a lot to be done before certain people can sit back and rest.

For one thing, noise and noise measurement still depend upon the human equation. Curious, isn't it, that while the finest scientific instruments are employed in the control and measurement of gear cutting, bearing fits, clearances, oil films, etc., the final results of all this painstaking and costly procedure are gaged by the human ear!

Noise and sound are exceedingly complex. So much so that even the scientists specializing in acoustics despair of a simple solution for the present. Most engineers view the situation with even greater hopelessness and choose to rely entirely upon the judgment of a good tester or inspector.

Nevertheless, we are confronted with a serious production problem. Something must be done about it, even if only a compromise. Whether a simple solution is possible is something else again.

Our purpose in this article is to discuss the fundamentals involved, something about the present state of the art, current methods of testing, etc. The presentation is based upon authoritative sources whose cooperation is gratefully acknowledged here and credited specifically at various points.

In gathering this material we found an unusual amount of activity in many quarters. For example: General Motors Research already has a rich background of experience going back some eight years. A group of research workers at the University of Michigan have worked out some brilliant solutions for automotive and industrial machinery problems over a number of years. Then there is the excellent work of the Burgess Battery Co., General Electric, Western Electric, Westinghouse and others who have participated actively in the development of instrumentation and the general rationalization of the fundamentals involved.

Perhaps the chief reason for our active participation in this study is an effort to contribute something constructive to perplexing problems confronting production men and engineers in the automotive industry. For example, here is an excerpt from recent correspondence: "The measurement of noise is one of the most serious problems we have to contend with. At present it is not possible to set up standards, and the acceptance or rejection of an engine or motor depends entirely upon the feelings of the man charged with this responsibility. You can rest assured that we have some lively arguments almost daily, the final decision usually being my job."

Another, along the same line says, "For checking noises, we do probably the same as most others—de-

pend on the human element. Quite frequently a group of us get into a huddle and 'decide' whether a piece of equipment is noisy, quiet or commercially okey. We had one engineering specification which stated that the inspector was to stand three feet away and reject if noisy. A very complete specification."

Now the difficulty with standards which depend upon the human element—and here we bare our neck to the axe—is the fact that humans are not standard but vary considerably in sound perception and their reaction to the quality of sounds. That's only one set of variables. But consider also that the "standard" represented by an individual is a variable. It is constantly changing, not only over long range periods but from hour to hour during the day. Soft pie crust or slightly tainted oysters will affect the reaction of any man's ear after lunch.

from Din of Quieter Cars

It's all well and good for an automobile builder to set standards by ear at the present stage of the art—at least we will admit it for the sake of argument. But what of the parts maker, whether he be an outside organization, a subsidiary, or even within the same factory?

To what standard of quality shall the transmissions, rear axle, or engine be built? By what standard will it be judged? Can we be complacent or even comfortable in the knowledge that the best we can do in present-day manufacture is accepted or rejected solely on the "judgment" of an inspector—by a standard that can't be expressed in rational units.

It's serious enough where the unit is built for only one make of car. But what of the parts maker who caters to a number of car builders? On purely theoretical grounds. as will be explained later, the unit made to the same mechanical standards may not be acceptable *per se* to more than one of a group of customers. And in practice, acceptance again depends upon the personal element, with all the variations due to dealing with an increasing number of critical ears.

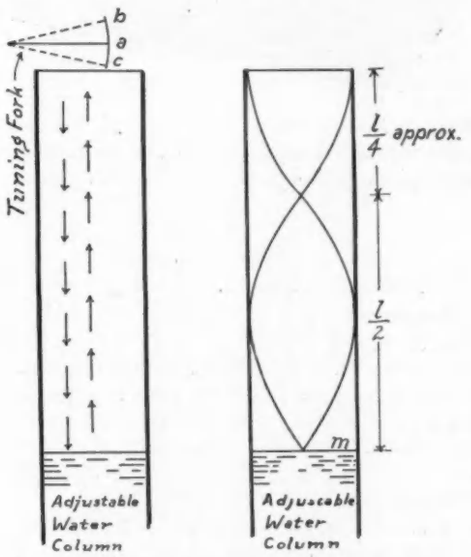


Fig. 3—Elementary method of measuring frequency by gaging the wavelength of a sound wave. This is an illustration of the phenomenon of resonance through sound-box effect

The upshot of the thing is that a number of suggestions are proposed by the people who have been close to the problem for a long time. It is proposed:

1. That standards be established on some measurable physical basis. This will involve the development of suitable instrumentation.
2. That standards should originate from an analysis of the finished car which seems to suit the public. And that this standard is to be reflected in the specification of the individual units.
3. That this be parallelled by suitable laboratory and pro-

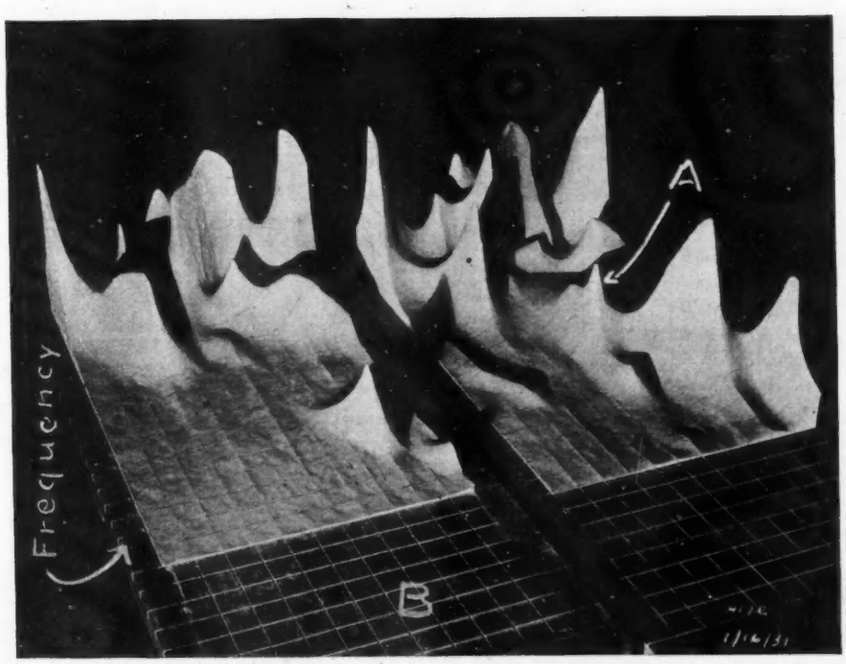
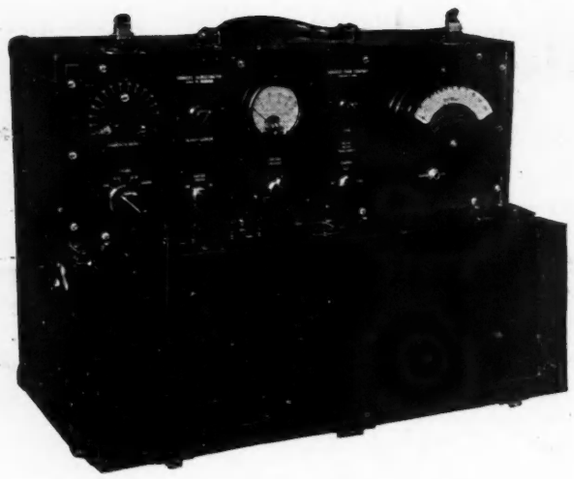


Fig. 2—G.M.R. model in clay showing three-dimensional picture of a sound spectrum. Board at the right, "before"; B, "after." Peak at A was the only offending frequency when tested in a car



Burgess Acoustimeter, one unit of a line of noise-measuring equipment. The meter at the right gives readings of total noise in decibels

duction methods supported by measuring and testing equipment.

Before we leave this phase of the discussion, it is well to reemphasize the complexity of noise and its measurement. The human ear is a remarkable organ. It has a very wide range and is capable of analysis not possible with any instrument developed by the laboratory. But by far the most difficult aspect is the fact that the ear is affected by both physiological and psychological reactions of its owner. That is to say, it is profoundly affected by the workings of a person's nervous system.

Consequently, what's meat for one is poison to another. Moreover, not all sound is noise or is objectionable. For instance, most people seem to like the dull "thud" of a steel door. Many people like the powerful song of a good big engine, although they may object to the roar of a carburetor intake or tail pipe. The point is that one's judgment of whether a sound is too loud or otherwise objectionable is greatly influenced by how he thinks it should sound. Many car owners do not know which are the sounds of essential parts and their judgments certainly differ from those of the builder.

The ear is more sensitive to certain frequencies than it is to others. In fact, there may be a good many frequencies or tones present and only one or two are really objectionable and then only if they are of sufficient intensity.

Don't miss this point. Frequently, only one or two tones out of the gamut present become important because they are in resonance with a particular size or shape of body or hood. These are the only ones to worry about; they are the only ones that need amputation. That one or that series should be watched in production. But it may not be and probably is not the same one on two different cars.

This is the general picture. It is a setting that demands action, quickly.

Now for the fundamentals of an art that presents much complexity, much beauty, a lot of headaches.

First, let us examine the possible sources of sound and vibration in an automobile. In a paper read early this year before the Pittsburgh section, S.A.E., William Jack[1] summarized the sources of noise as follows:

a. Disturbance due to rotation of engine, torque reaction, gas flow, intake and exhaust, fan.
b. Gears, transmission, timing, differential, valves.
c. Tires.
d. Wind currents.

To this we might add body noises due to vibration, rumbling of panels and dash, squeeks, etc.

To show the complexity within any single unit that is being analyzed, we have the excellent picture given by E. B. Neil[2] who described a muffler study in a recent issue of *Automotive Industries*. He makes the following analysis:

"CAUSES OF NOISE.

1. Study of sources and determination of relative importance.
   (a) Moving parts (mechanical contacts).
   (b) Exhaust disturbance.
      (1) Pulsating flow.
      (2) High velocity flow.
      (3) Manifold, exhaust pipe and cylinder resonance.
   (c) Intake disturbance.
      (1) Power roar.
      (2) Hissing.

"CHARACTER OF NOISE.

Frequency analysis of sources, for

   (a) Engines having various numbers of cylinders from one to eight or more, both two and four-stroke cycle.
   (b) Determine frequencies and intensities for idling, acceleration and deceleration, both with and without maximum loads.
   (c) Similar determination to cover entire range of engine speeds when engine is carrying its load (i.e., in automotive work, when engine is mounted in the car, bus or motor truck.)

Again, through the courtesy of Dr. E. J. Abbott of the University of Michigan, we have been given permission to quote from an unpublished paper[3] dealing with a remarkable series of studies on rear axle noise

[1] "Acoustical Treatment of Automotive Problems," by William Jack. Paper read before Pittsburgh Section SAE., March 1, 1932.
[2] "Recording Instruments Replace the Listeners Jury," by E. B. Neil, *Automotive Industries*, October 3, 1931.
[3] "The Measurement of Rear Axle Gear Noise on Test Stands," by E. J. Abbott and F. A. Firestone, unpublished.

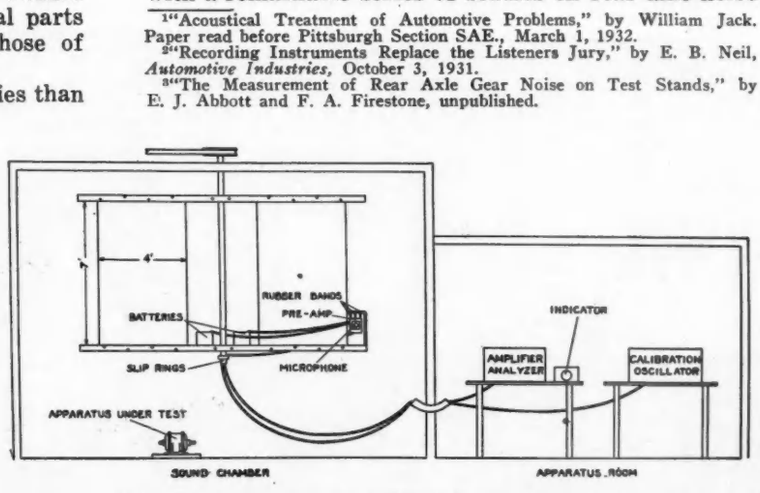


Fig. 4—Arrangement devised by Abbott and his associates at the U. of M. (3) to average out the effect of confusing wave patterns in a sound room. Note that all apparatus is located in a separate room, leaving only the unit under test and microphone pick-up in the sound chamber. Suspended from the ceiling is the revolving reflector which is employed to break up the wave patterns

and their measurement. Briefly, they found that:

"The primary source of gear noise lies in the fluctuations of the force between the contacting teeth. The fluctuating components of this force are largely due to peculiarities in geometry which produce secondary motions of the gears, and to shifts in the direction and point of application of the normal force between the contacting teeth. In addition these are also tangential frictional forces which depend upon the various rubbing velocities of the teeth. The factors which affect these fluctuating forces are many and varied. Among them might be mentioned design, manufacture, assembly, adjustment, deflection under load, and lubrication.

"The fluctuating forces produce vibrations in the gears and in their supports. These vibrations are transmitted throughout the entire stand and are finally communicated to the surrounding air where they produce the sensation of sound in any human ears present. Certain of these virbrations, as for example, those of rotational frequency, are of such low pitch that they can be easily felt with the hand, though they produce but little audible sound. On the other hand, those vibrations which produce the sensation of sound cannot ordinarily be felt. The amplitudes of these machine vibrations are of the order of a few millionths of an inch, and the frequencies a few hundred cycles per second.

"Measurements show that a large part of the audible vibration is very definitely related to the frequency of tooth contact. For example, if an eleven-tooth pinion is operated at 1200 r.p.m., there will be $11 \times \frac{1200}{60} = 220$ tooth contacts per second. It has been found that a note of this frequency is almost certain to be very prominent both in the vibration of the machine and in the neighboring air sound. In addition to this note a number of related notes have been observed. These notes have frequencies which are 2, 3, 4, etc., times the frequency of tooth contact. In many cases these higher-frequency notes are considerably louder than the note of tooth-contact frequency. Such series of musical notes are well known and are called harmonic series."

What is sound and noise? According to classical physics as in Ganot[4], sound is a peculiar sensation excited in the organs of hearing by the vibratory motion of bodies. Sounds are distinguished from noises. Sounds—musical sounds are those which produce a continuous sensation, the musical value of which can be estimated. Noise is either a sound of too short duration or else a mixture of many discordant sounds. Yet the difference between sound and noise is by no means precise.

According to Jack[1], sound is a pressure disturbance in a medium which alternates above and below an average value. We are particularly interested in sound waves in air, where the propagation is entirely as a wave motion. The motion of air particles is back and forth in a direction parallel to the propagation of the wave.

The principal physical characteristics of sound or noise (which we may use synonymously here) appear to be as follows:

1. Intensity—which in acoustic determination may be considered as the power in a sound wave passing through a unit area.
2. Frequency—the number of complete cycles per second which any vibrating particle undergoes. Pitch of a pure tone is determined by its frequency.
3. Duration.
4. Quality—a measure of wave-form, also termed "timbre." It is a term used to differentiate between two complex sounds of the same dominant frequency which may be identical in intensity.

Because loudness is a sensation akin to such general concepts as brightness, coldness, heaviness, etc., many workers in the domain of acoustics have accepted an absolute unit, the "decibel" (db) representing the logarithm of intensity. Practically, it has the advantage of being roughly the minimum change of loudness that can be detected by the ear.

A sound may be too faint to be heard and it may be intense enough to cause pain. By "averaging" the results of tests on a number of people, a scale of loudness has been constructed to represent the "average" threshold of hearing, the minimum range of the human ear, and the threshold of feeling, the upper range. A familiar form of this logarithmic curve is found in Fig. 1 reproduced from a recent paper by K. H. Pratt[5]. From this we may estimate the limits of frequency and loudness that are within the "average" range, in terms of physical as well as loudness units.

General Electric Audio Noise Meter-Analyzer Unit. This is used in conjunction with a totalizing instrument and serves to separate the noise pattern into frequency bands

The real difficulty, according to Dr. Abbott, is this: "The relative sensitivity of the ear to different frequencies varies enormously with the loudness of the sound. The ear also 'adds up loudnesses' of complex sounds in a very peculiar way. As a result it is difficult to find a system of units based on physical measurements (as they must be to have any meaning) in which a larger number will always represent a louder sound to the average ear, and where the numbers associated with different sounds will bear a reasonable relation to the way it sounds so that the data can be readily interpreted by ordinary people. It is also desirable to be able to design a meter to measure directly in these units. Theoretically this appears to be impossible, but compromises have been reached, which on the basis of experimental tests at this laboratory and others show up very much better on practical noises

than one would expect."

We might mention in passing that the American Standards Association set up a committee on noise measurement early this year. The first report of the sub-committee was presented on May 4, 1932. It dealt chiefly with certain fundamental definitions such as that of a pure tone, zero level of intensity, and methods of observations.

It is important to mention at this point that physicists in industry are not all reconciled to the use of the decibel or the limits of human perception based on the "average" ear. These men feel that there is too much variation in ears to be averaged successfully. Moreover, in dealing with the physical units of sound, they prefer to work with a linear scale rather than a logarithmic one, such as the decibel scale.

Western Electric Sound Frequency Analyzer. It makes measurements of the individual frequency characteristics in a complex sound

At General Motors Research, we found a very instructive and exceedingly simple device by means of which we may visualize the complexity of the practical application of noise measurement. By the same token, this device shown in Fig. 2, sheds a good deal of light on the important elements of the problem.

Fig. 2 is a three-dimensional clay model of a graph depicting the results of a complete series of sound measurements on an automobile unit. It looks for all the world like a contour map of Western Pennsylvania. Actually it represents the unique sounds, their intensity, and location. Frequency is plotted against engine speed while intensity or loudness is the vertical dimension.

The board to the right is "before"; the one in the foreground, "after."

How would you interpret these data? In the first place, the bulking of huge masses at the extreme left along the line of ordinates just doesn't mean a thing so far as sound suppression is concerned because the sounds lie below the audible range. Of course, some of this may be resolved into vibration and should be counter-acted by rubber mounting or spring suspension. In a similar fashion, some of the masses at the extreme right are out of the audible range and may be relatively unimportant.

It is even conceivable that much of the audible sound is not very loud and can't be heard at some distance from the unit. What to do? Well, the acid test at G.M.R. is to put the unit in a car and watch for the frequency or frequencies that are objectionable in the vehicle.

Right here we can state a most important fundamental in acoustical work. It's not the wave pattern or the bulking of noise as in Fig. 2, that counts—it's the effect of resonance or reenforcement of one or more unique frequencies that really gives the trouble.

Resonance, as you will recall is the sound-box effect such as is noted in the case of a mounted tuning fork or a violin or drum, in which the sound is reenforced and in the case of musical instruments, enriched by harmonics and overtones.

This phenomenon and its quantitative effect are demonstrated by a very simple experiment which most of us recall. Consider Fig. 3. Here is a long glass tube arranged with an adjustable water column so that the level can be changed at will. An electrically excited tuning fork is mounted at the open end. The water column is shifted progressively until the sound emitted by the fork becomes reenforced and louder than in any other position. This is the first point of resonance and the distance from the top of the tube to the water level is approximately one-quarter wave length.

In proof, consider that in moving from position b to c, the fork has made one-half vibration or equivalent to a half-wave length. For reenforcement, the air column must vibrate in phase, must reach the nodal position on the condensation movement and travel upward in time to move with the fork as it begins vibration from position c to b. The total distance travelled up and down is one-half wave length; the half distance is one-quarter wave length.

Coming back to Fig 2, it was found on road testing that only one frequency was of real significance. This is represented by the peak at A which seems quite innocuous and relatively unimportant on the board. The way this was discovered is that an annoying noise was evident at only one engine speed, this being readily traced to a particular wave length or frequency corresponding to this speed. Thus only one sound out of the spectrum traced on the board is in resonance with the sound box proportions of the car.

It is possible as suggested earlier that the same unit, with its unique sound spectrum would behave differently in another make of car. And a different frequency or frequencies may be annoying. That's where the headaches of this work come in.

The next step at G.M.R. was to do away with the offending sound. How that's done is nother story. Suffice it to say that the sound was eliminated, producing the spectrum on board B. Note that peak A has disappeared; moreover, whatever they did also erased most of the high frequency peaks around it.

Now a few words about the setting of standards for noise inspection. Very little information is available in the present state of the art. But considerable work has been accomplished on some simple machines which are complete within themselves and not subjected to the ill effects of resonance with some other structure.

One successful project is described in *Mechanical Engineering* for April, 1932[6]. This is on the inspection of cream separators for which three measurements are specified, the bowl-spindle note, the low-gear-note, and the high-gear-note. Three microphones are employed, one for each measurement, each located at a fixed position with respect to the region being measured.

Abbott, one of the investigators on the above reference has reported a similar study[7] to the Accoustical Society of America. This was a study of large gear reduction units out of which came specifications on the basis of the four characteristics—average total noise, the largest single note, the combined musical notes, and the unpitched sound.

For automotive units it is felt by some physicists that a total noise instrument is of little value because it gives no clue to the offending frequencies. Accordingly, the analyzing instrument seems best suited since it breaks down the total noise into a spectrum. Various forms of instruments for routine inspection as well as for the laboratory will be described in the second part of this article.

In concluding the first part of this study, we may summarize the situation as follows:

1. That specifications for noise measurements on automotive units should proceed from the analysis of the behavior of a given unit as assembled in the finished car.
2. That noise specifications for the same unit may vary with changes due to installation in a different running gear or a different body, or a different make of car.
3. That the ultimate inspection device is quite likely to be an analyzing instrument having either a wide range as in the case of commercial machines or a narrow selective range if developed for individual problems.
4. That the specification must recognize the personal reaction of car owners as well as inspectors in setting the original standard.
5. That specifications must be treated as individual problems unique for each mechanism or machine or complete car.
6. Finally that specifications not only are desirable but an absolute essential to engineering development and economical manufacture.

[4]Ganot's Physics—Atkinson. (1919)
[5]"The Significance of Noise Measurements" by Kenneth H. Pratt, *Electrical Engineering*, October, 1932.
[6]"Reducing Noise of Machines," by F. A. Firestone, F. M. Durbin, E. J. Abbott, *Mechanical Engineering*, April, 1932.
[7]"Noise Specifications for Large Reduction Gears in Terms of Physical Units," by E. J. Abbott, *The Jour. of the Acoustical Society of Amer.*, April, 1932, vol. 3.

Vanadium Steel Dies for Spark Plug Manufacture

VANADIUM "tool-steel" dies have been in use by a manufacturer of spark plugs for extruding blanks from which the porcelain parts of the plugs are formed.

Abrasion tests were made at the Bureau of Standards on dies furnished by the spark-plug manufacturer in which the "standard" plastic abrasive material of 60 Maryland clay and 40 glass sand passing 20 mesh was used. These tests were followed by tests in which the plastic porcelain spark-plug composition (all passing 200 mesh) was used as the abrasive medium.

The results obtained with the "standard" abrasive are expressed by the equation $25.31y^{0.525}=X$, which represents the relation between abrasion loss y in mm^3 and extrusion pressure X in kg cm^2.

The equation obtained with the porcelain material as the abrasive medium is $159.0Z^{1.155}=X$. At the same extrusion pressure the abrasive "influences" or "intensities" of the two abrasive materials can be compared.

Under this condition, $159.0Z^{1.155}= 25.21y^{0.525}$ or $Z=\frac{y^{0.55}}{4.926}$.

At an extrusion pressure of 10 kg cm^2 the comparative abrasiveness of the two abrasive mediums expressed in terms of "abrasion loss" is $Z:y= 1:2.557$, while at 50 kg cm^2 extrusion pressure the relation is as 1:8.005.

It appears, therefore that abrasive loss increases at a more rapid rate as extrusion pressure increases for an abrasive of coarser grain than is the case for an abrasive of finer grain.

In the "standard" abrasive the effective abrasive material is quartz sand (hardness Moh's scale=7.0) passing a 20-mesh screen, whereas the effective abrasive material in the porcelain material is andalusite (hardness Moh's scale=7.5) passing 200 mesh in fineness.

Alloys Superior to Carbon Steel in Endurance Test of Valve Springs

(Continued from page 675)

by examination with a hand lens. The wire had a lower slag content than any other.

Good torsional fatigue properties were secured after heat treatment. The comparative absence of longitudinal cracks is taken as indicating the ability of the steel to withstand severe quenching.

The Swedish steel wire had the following composition: 0.49 C, 0.18 Si, 0.013 S, 0.032 P, 0.79 Mn, 1.41 Ni, 1.38 Cr.

When oil-hardened at 1550 deg. F. and tempered at 790 deg., this steel showed a static tensile strength of 206,000 lb. p. sq. in. and a torsional breaking strength of 150,000 lb. p. sq. in., while its torsional modulus of elasticity was 11,000,000 lb. p. sq. in. Hardness tests showed no reduction in hardness near the skin. About 50 per cent of the fractures of the reduced-diameter specimens (reduced after heat treatment) and 25 per cent of the full-diameter specimens had no marked longitudinal steps. The remaining fractures were mainly of a type not previously observed, the central surface of the fractured portion consisting of a solid or hollow cone, the outer rim being of normal form. Longitudinal sections showed the wire to be more nearly free from non-metallic inclusions than most other commercial spring steel wires. Inclusions in the form of streaks were observed, however.

When heat-treated at full diameter the wire gave a safe range of stress of about 20,000-80,000 lb. p. sq. in., which is a high range for commercial spring steel wire. When the heat-treated wire is reduced in diameter by 20 per cent the limiting stress range appears to rise to 31,250-125,000 lb. p. sq. in. As regards increase in the fluctuating-torsion test results by reducing the diameter after heat treatment, the results were about the same as with the specially prepared chrome-vanadium steel wire.

C. F. R. Committee Determines Anti-

Modified test engine and new procedure evolved give results that agree with those of standardized road test.

ROAD tests for the purpose of establishing knock ratings of motor fuels, held at Uniontown, Pa., some months ago, yielded results that did not agree with those obtained from the same fuels by the C.F.R. tentative recommended practice for laboratory anti-knock tests, and it was therefore decided to make certain modifications in the C.F.R. engine and in the test procedure for use with this engine. The Road-Test Correlating Sub-Committee of the C.F.R. Committee, which conducted the tests at Uniontown, therefore arranged for tests to be made in the laboratory of the Waukesha Motor Co., to determine what these changes should be.

At the outset, a shrouded intake valve was designed for the test engine, to give the charge a swirling motion as it enters the combustion chamber. The valve is held in such a position that the opening in the shroud is in the direction toward the bouncing-pin hole, and the object of this shrouding is to give more nearly uniform knocking and steadier knockmeter readings. In addition, an improved type of vapor condenser was provided and the circulating pump was eliminated.

The lack of correlation between the results of the original laboratory knock test and the Uniontown road tests is shown by the left-hand chart of Fig. 1, which is taken from a paper by C. B. Veal, H. W. Best, J. M. Campbell, and W. M. Holaday, read before the American Petroleum Institute at its recent annual meeting. The chart shows that the difference in the octane ratings by laboratory and road test is about 10 per cent, the equivalent of 2.5-3 octane numbers, in the case of commercial fuels, and as much as 35 per cent, the equivalent of 9 octane numbers, in the case of a cracked naphtha.

It had been found previously that the knock rating obtained with the C.F.R. engine varies with the engine speed, the mixture temperature, the jacket temperature, the throttle opening, the valve timing, and the piston temperature. The effects of changes in these various factors on the correlation between laboratory and road results were thoroughly investigated and as a result a new tentative recommended procedure for conducting commercial anti-knock tests of motor fuels was worked out.

The old procedure is not discarded but will be known hereafter as the C.F.R. research method, while the new procedure will be known as the C.F.R. motor method of conducting anti-knock tests. For both methods the following modifications have been made in the C.F.R. engine: A shrouded intake valve is now used and an improved type of vapor condenser is provided. The jacket-cooling water-circulating pump is eliminated. The correlation between results from the road tests and those from the new motor method is shown by the right-hand chart of Fig. 1.

The C.F.R. motor method differs from the C.F.R. research method in three respects, involving further definite changes in equipment and procedure. The

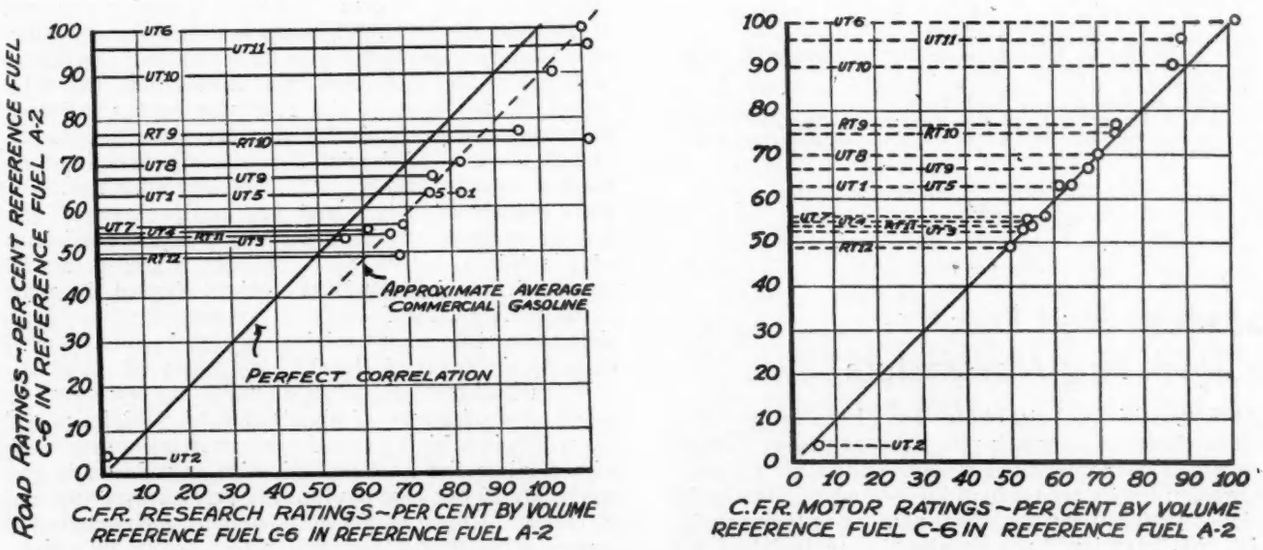


Fig. 1—Road-test correlation with results from C.F.R. engine by research procedure (left), and motor method (right)

Knock Values by New "Motor Method"

engine speed, which is 600 r.p.m. for the research method, is 900 r.p.m. for the motor method. Whereas in the research method the spark advance is set for maximum power, automatically adjusted, in the motor method the spark is set to occur 26 deg. ahead of top dead center for a compression ratio of 5 to 1, the same automatic adjustment being retained; with other compression ratios the spark adjustment follows characteristics imposed by the timing mechanism used with the research method.

Whereas the mixture temperature is not specified for the research method, for the motor method this temperature is limited to 300 F. plus and minus 2 deg. The heat required to bring the mixture up to this temperature is supplied by a special electric heating unit introduced between the carburetor and the intake port. The mixture temperature must be measured by a special mercury thermometer, in the intake manifold at the entrance to the cylinder head of the test engine.

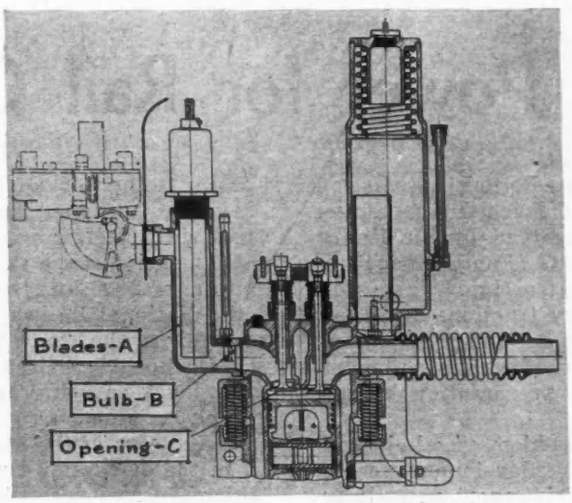


Fig. 2—Sectional view of C.F.R. engine cylinder head, showing electric mixture heater, shrouded intake valve, and improved type of vapor condenser

To insure the most satisfactory results, the motor method was made to differ from the research method also in the following particulars:

1. The proper knock intensity for use with the bouncing pin should be obtained by operating the engine on a standard reference fuel of approximately 70 octane rating, determining the compression ratio at which the first audible knock occurs, and then increasing the compression ratio by one unit. The intensity of knock increases with an increase in the compression ratio. The compression ratio for the first audible knock should be obtained by increasing the ratio from a point where there is no knock—by increments of two turns of the crank—until the first audible knock is detected.

2. The following instructions for setting of the bouncing-pin contacts should be used: With the daily inspection, observe the contact points and electrical connections to see that the points are smooth and that all the connections are tight. The gap setting should be checked (0.003 in. to 0.005 in.). The flat spring of the lower contact should touch the insulated pin with slight pressure. Too much pressure will reduce its sensitivity. To adjust the pressure accurately, set the points with 0.003 in. to 0.005 in. clearance. Then remove the diaphragm and bouncing pin. Bend the lower spring until there is from 3/64 in. to 1/16 in. gap between the points. Remove the upper stop-adjusting screw, and bend the upper spring up until there is 5/32 in. gap between the points. Check the tension on the small plunger spring, in upper stop-adjusting screw, and see that it has from 1 to 1¼ lb. initial tension. This can be measured by pressing it against any convenient platform scale. The pin should then be reassembled and the adjusting screw set to give 0.003 in. to 0.005 in. gap between the points. The final adjustment is made by setting the clearance so a knock-meter reading between 50 and 60 is obtained when operating the engine at the proper knock intensity.

3. A separate exhaust pipe should be used for each engine. This pipe should be made from 1¼ in. pipe having a maximum of two 1½-in. ells with a total length not to exceed 20 ft. Use of a short, "straight-through" muffler of 1¼-in. diameter passage, for prevention of noise, is permissible.

4. The inlet mixture temperature should be kept constant throughout the test at a temperature of 300 deg. F. plus or minus 2 deg.

5. Proper condition and operation of the test engine should be checked at frequent intervals by using the motor method to obtain knock ratings on the special benzene-heptane standard reference fuels calibrated for that purpose. These special reference standards are prepared by blending definite percentages of volume of C.P. benzene with normal heptane, and for a given blend have a definite standard C.F.R. motor octane number. If the octane number as determined for a given blend by the C.F.R. motor method differs from the predetermined standardized knock rating of this fuel, the engine is not operating satisfactorily, and should be so adjusted as to give the proper results before knock ratings are made.

The Sub-Committee on Methods of Measuring Detonation of the Cooperative Fuels Research Committee also has issued the following instructions for the C.F.R. road-test method for conducting anti-knock tests:

Road knock ratings on motor gasolines shall be made by a method involving a comparison between the sample to be rated and a reference fuel; this compari-

son to be made by comparing the maximum knock intensity produced by the sample with the maximum knock intensity produced by the reference fuel, without regard as to whether maximum knock occurs at the same or different speeds for the sample and the reference fuel.

More specifically, in rating a fuel in a car by this method it is necessary to determine:

1. The relative knock intensities produced by the sample at different speeds in high gear during either slow acceleration or slow deceleration with substantially identical vehicle loading.

2. The relative knock intensities produced by the reference fuels at different speeds under the same test conditions during a similar period of slow acceleration or deceleration. From these data the speed required to produce the maximum knock intensity for each fuel, i. e., sample and reference fuels, is determined.

3. Finally, the knock intensity produced by the sample at its speed of maximum knock is to be bracketed between knock intensities produced by two reference fuels at their maximum-knock speeds.

The rating is then expressed in terms of a reference fuel which will produce a maximum intensity that matches the maximum knock intensity produced by the sample to be rated.

Ratings by this method are to be made at full throttle and within a speed range of 15-50 m.p.h.

Oil Engine Power for Rail Cars

AT the recent meeting of the British Association for the Advancement of Science a paper on "Oil Engine Power" was read by Sir Henry Fowler at a session of Section G (Engineering) devoted to the subject of railway traction. Papers on the other two forms of railway traction, by steam and electric power, were also read, and a rather interesting discussion bearing on three systems of railway traction followed the presentation of the papers.

Sir Henry Fowler said the problem of oil-electric power on railways was of particular importance in Great Britain because of the Weir report on railway electrification. The subject had received some attention as far back as 1885, when Daimler developed the first high-speed gasoline engine, and 1895, when Diesel brought out his oil engine. The first main-line locomotive with oil power was built for the German State Railways in 1912, the frame having been built by the Borsig Works of Berlin and the 1000-hp. engine by Sulzer Brothers of Winterthur, Switzerland. The engine was started by compressed air, carried on the locomotive in pressure vessels. This was said to be the first and only large oil-engine locomotive ever built with direct mechanical drive. He had seen the locomotive and had realized the difficulty of starting with a considerable load. The lack of flexibility of the internal combustion engine was not fully realized at the time, and many engineers do not fully realize it now. But while this was a disadvantage of the oil engine, its ease of control was an advantage. The four great problems in connection with Diesel engines for large locomotives related to weight, lack of flexibility, transmission requirements and cost, and, if these could all be satisfactorily solved, there was no doubt regarding the future of the oil engine in the railway field.

Weight could be reduced sufficiently by going to higher speeds, and, as regards transmissions, the electric system was the only one suitable for a locomotive of any size. Unfortunately this type of transmission was heavy and expensive, and he figured that an oil-electric locomotive for passenger service cost about twice as much as a steam locomotive of equal capacity.

Main-line oil locomotives, the author said, constituted the most interesting problem. He referred briefly to the work of Professor Lomonossoff, who, he said, had designed the first large oil-engine locomotive with electric drive that had been built, and he also mentioned the two units, coupled together, with a total of 2600 hp., that are being used on the Canadian National Railways. Another promising experiment was the "mobile powerhouse," in service on the Buenos Aires Great Southern Railway, consisting of a truck carrying an oil-electric generating plant which supplies current to railway motors on the individual cars of the train.

In the discussion Dr. W. Lowe-Brown said that in suburban services rapid acceleration was an important requisite, and this was made impossible by the great weight of present-day railway equipment. Whereas a motor bus has a gross weight of only three tons per ton of passengers at full capacity, the weight of the railroad trains is from 8 to 10 tons. The division of weight in different types of railcars is given in the following table:

	Steam Tons	Electric Tons	Drumm Battery Tons	Diesel-Electric Tons	Motor Bus Tons
Passengers	40	40	40	40	4
Coach	200	200	200	200	4
Strengthening of bogies	..	23	50	23	..
Power unit	80	37	130	97	4
Total	320	300	420	360	12

C. J. H. Trutch mentioned that on the Buenos Great Southern Railway a Diesel electric locomotive had run 15,000 miles and only once in that mileage required assistance from another locomotive, and that was due not to failure of the Diesel engine, but to a short circuit in the electric drive.

Wing Commander Cave-Brown-Cave thought that suburban lines should be electrified, but it was questionable that main lines outside the suburban areas would be electrified for a long time, or at all. He thought the solution of the problem lay in the use of powerplants on wheels which would supply the electric power as soon as the electrified part of the line was left behind. These rolling powerplants, instead of having a single large engine, as has been customary in the past, should follow a plan suggested by Ricardo in another connection in having 10 to 12 oil engines of the type now built for road traction, which could be produced very economically.

Calibrated Colors Have Three Dimensions

In much the same manner as the size of a room can be described in length, width and height, so, too, can color be portrayed

WITH the object of limiting the color variations employed in automobile finishing, said to total 11,500 today, to a practical number, the Duco Color Advisory Service has proposed the use of a series called Duco calibrated colors.

If pigments of a purity comparable with sunlight were available to lacquer manufacturers, a system of automobile colors could be built around a triad of fundamental hues comprised of red, green, and purple blue. Until pigment purity attains this perfection, five principal hues, viz., red, yellow, green, blue and purple, are required as a basis. The intermediate and secondary intermediate colors employed in the "Duco calibrated color" series are based on these five key hues. Intermediate hues, made from mixtures of the five original color families, are yellow red, green yellow, blue green, purple blue, and red purple. The secondary intermediate range of hues completes the circuit of hues by representing, together with the two hue classifications already referred to, every color family at its fullest hue strength. Red yellow red, yellow red yellow, yellow green yellow, green yellow green, green blue green, blue green blue, blue purple blue, purple blue purple, purple red purple, and red purple red, are the secondary intermediate colors and complete the hue circuit, and all of these variations are represented in the "Duco calibrated color" series with exceptions noted in the following:

Owing to the fact that outdoor-exposure requirements must be met, four of the twenty hues comprising a portion of the color circuit "purple, purple red purple, red purple, and red purple red," were omitted, the aim being to include only durable color families.

Each of the color families or hues is subdivided according to color dimensions called value and chroma. Until January, 1932, little was known about chroma in automotive art and color departments. Hue (the quality by which red is distinguished from green; purple from yellow, etc.) and value (the lightness or darkness of a given color) constituted the only known dimensions with which color was described in the automotive industry. Light values are sometimes called tints, and dark values are known as shades. In this new series of calibrated colors, the lowest or darkest value is black and is represented by a notation of triple zero (000). White, the lightest or highest value, is represented by 9. Between these two extremes of value there have been developed ten visually calibrated neutral sequences from dark to light, designated in this order by the following symbols: 00, 0, 1, 2, 3, 4, 5, 6, 7, and 8. These twelve neutrals are one dimensional—that is, they lack hue and chroma characteristics.

By actual count, 413 so-called gray colors have been compounded to meet "automotive production needs." It is proposed that this large number be replaced by ten neutrals ranging between black and white. Blue grays, green grays, warm grays, and the like are merely extremely weak chroma variations of the blue , green and red color families.

In much the same manner as the size of a room can be described in three dimensions—length, width, and height — so, too, can color be adequately portrayed by a use of the three recognized fundamental color dimensions, viz., hue, value, and chroma. Chroma expresses concisely the third dimension of color. Chroma is the degree of departure of a color sensation from neutral. An olive green is a green of exceedingly weak chroma. An emerald green is described as possessing strong or powerful chroma.

By the general adoption of these color terms in the automotive industry, it will be possible to describe and convey impressions of colors most accurately. In place of attempting to describe Powhatan buff by saying it is sort of a deep, dusty, muddy, yellowish kind of brown, we can call its appearance vividly to the mind of one familiar with these color dimensions by saying it is a yellow red yellow at three steps of value and one step of chroma. This means that it is a yellowish brown of low middle value, lacking brilliance or purity. The color we call brown does not appear in the spectrum. Brown is, however, a low value of yellow red or yellow red yellow.

A survey of color gallonages recently completed by the Automobile Color Index in cooperation with the automobile manufacturers revealed that not more than two hundred color variations had been employed in any one month (including the peak months of April and May, 1928 and 1929) from which it follows that the total number of 11,500 variations greatly exceeds production needs.

It is claimed that when colors are systematically prepared to completely represent every full-strength color group, it is a relatively simple procedure, in the event a green or yellowish hue is required, to select from the yellow green, yellow or green yellow color families the exact color desired.

Another practical virtue claimed for colors arranged systematically is protection from obsolescence difficulties. With calibrated colors it is said to be an easy matter to alter any color in any hue by adding another color of the same hue, provided the color added differs in value or chroma or both. By adding an equal amount of a color's complement, of the same value and chroma, a neutral may be obtained. Unequal proportions of base color or complement produce good grays of slight hue characteristics, dependent upon which hue predominates. Purple blue, for example, mixed with yellow, with purple blue predominating, makes a warm bluish gray.

Automotive Oddities—By Pete Keenan

The News Trailer

"They done it! They done it! Danged if they ain't flew!" Breathless, dismayed at seeing things he didn't dare to believe, an unknown Kitty Hawk fisherman thus reported the historic flight of Orville Wright on December 17, 1903.

Twelve seconds in the air with a coughing 12 hp. engine; twelve years more and newspapers headlined the daring of Richtoven, Rickenbacker and other intrepid war aces. Sixteen years later the Atlantic had been spanned and soon man had flown through the gales of the seven seas, across the horizons of deserts and over barriers of mountain ranges.

Now, as a shaft has been unveiled near the scene of the 540-foot flight of Orville Wright, nearly 200,000 miles of air transport routes on every continent and across many seas are being traveled every day, every night, by thousands of pilots of the skies.

"And we're just beginning, just on the threshold of REAL aviation development," chorus the engineers who have learned much since that experiment on the sand dunes of North Carolina—not 30 years ago.

Tire dealers of the United States Rubber Co. are now making free "safety print" tests to determine a tire's "safety rating," by obtaining the tread pattern. A car equipped with tires which leave a sharp, nonskid impression can be stopped from a 30-mile-an-hour speed on wet asphalt in 51 feet. These tires have 100 per cent rating of winter driving safety.

Milk wagons have gone "low pressure"—of all things!

One of our engineering friends several weeks ago pointing out that with the extra-oversize tires, wagon builder could discard springs and other parts, thus saving enough to come out even on the entire vehicle.

Xantherses (we call him that, instead of "old Dobbin," just for a change) is pictured on page 689. Somewhat ashamed of the unconventional contraption, he turned the other way—but who knows but what he'll go down in history as the prime-mover of a very important development?

NEWS

Chrysler Will Spend $42,000,000 on Parts

Materials and Supplies Will Come from 17 Basic Industries, Executive Says

DETROIT, MICH., Nov. 22—Material purchases amounting to more than $42,000,000 will be made by Chrysler Corp. to be used in the manufacture of the new Plymouth Six Walter P. Chrysler said.

This sum will be spent for raw and finished materials within the next six to eight months, and will be divided among some 17 basic industries and many dependent manufacturing lines. Thousands of American workmen and their families in these industries will be directly benefited by the purchase of these materials.

Production in the Plymouth plant had been raised from 1000 to 1200 Plymouth Sixes per day for the balance of November, and Mr. Chrysler said that it is probable that 1200 cars will be built during December.

"Reasonable prices of materials are offered today by every source," he said.

"Raw materials included in the $42,000,000 commitment," according to Mr. Chrysler's statement, are: "Gray and malleable iron used in engine and other castings; rubber for 'floating power' motor mountings and used in 64 other points on the car; lubricating oil, plate and safety glass; lumber of various types; copper, brass; cotton; nickel; tin; zinc; lead; aluminum used in pistons and other parts; alloys used for closely machined parts; sheet metal used in stampings for all-steel bodies and many others.

"Semi-finished and finished materials used in the new Plymouth Six included in the commitments are: tires and tubes; wire and wood wheels; frames; alloy pistons; wool, leather and cotton cloth; cushion springs; steering wheels; bumpers; instruments of various kinds, windshield wipers; storage batteries; hardware; electrical fixtures; starting and lighting systems; and hundreds of smaller parts used in assembling the finished motor car.

"Commitments for a great many of these materials and supply purchases were made weeks before the new Plymouth Six was announced."

Buick Producing First New Cars

Output Delayed But Plant in Full Swing On 1933 Automobiles

FLINT, Nov. 22—New 1933 Buicks were coming off the assembly line at the Buick plant here as that department started functioning after a delay due to a late decision to add another new feature in the new models.

Former employees in the assembly plant were called back to work this morning as that department swung into action.

The improvement made in the Buick necessitated a change in the body design and production was held up for some time until the newly designed bodies were available.

Employees will not lose any time because of the delay, Buick officials pointed out, because the same number of cars are still to be manufactured.

G.M. to Discontinue Brown-Lipe-Chapin

NEW YORK, Nov. 22—General Motors Corp. will permanently discontinue about December 15 the operation of its Brown-Lipe-Chapin division, in Syracuse, which manufactures differential gears.

The production is being transferred to Flint, Mich. Alfred P. Sloan, Jr., president, gave two reasons for closing the plant.

One is that it is more economical to manufacture gears at or near the center of the automobile industry, and the other is that "taxes in Syracuse are considerably higher than in the average locality in which General Motors operates."

Cummins Diesel Uses $21.90 for Fuel In Transcontinental Run

78 hrs. 10 min. of Total Running Time from New York to Los Angeles, Averaging 41.2 m.p.h. for 3220 Miles Sets Motor Vehicle Record

by Joseph Geschelin

LOS ANGELES, Nov. 19 (*Special*)—The final revised report of the Cummins Diesel transcontinental bus record follows:

Left New York City 12:01 a. m. (Eastern time), Nov. 14.

Arrived Los Angeles 4:11 p. m. (Pacific time), Nov. 17.

Total elapsed time, 91 hours 10 minutes.

Total running time, 78 hours 10 minutes.

Total mileage, 3220.

Average elapsed speed, 35.3 m.p.h.

Average running speed, 41.2 m.p.h.

Fuel oil consumption, 365 gal.

Fuel mileage, 8.9 per gal.

Average fuel cost, six cents per gal.

Total fuel cost, $21.90.

Estimated average weight of vehicle with load, 21,500 lb.

Consumption of engine lubricant, 5 quarts for entire run.

I. H. C. Approves Willys ½ Ton Truck

Production to Begin Dec. 15 On International Harvester Jobs

TOLEDO, Nov. 21—Final engineering and sales approval was given to the new half-ton truck to be manufactured by Willys-Overland Co. here for the International Harvester Co., following a conference in Chicago today.

L. A. Miller, president of Willys-Overland, said production will begin about Dec. 15.

More Products Will Be Exhibited at Joint Show

DETROIT, Nov. 21—More actually new products will be introduced to wholesalers attending the Third Joint Trade Show of the N. S. P. A. and M. E. M. A. here, Dec. 5 to 10, than at any automotive trade show held in a number of years, according to replies received from manufacturers in a survey conducted by George L. Brunner, president of the M. E. M. A.

Ontario Adjusts Fees to Aid Smaller Cars

Increase of "Baby Cars" Expected as Result of Imperial Conference Tariff Rulings

TORONTO, Nov. 21—Expecting an increase in "low-powered" British automobiles in Ontario next year because of Canadian tariff concessions to the United Kingdom through the Imperial Economic Conference, the province has decided to provide further advantage by a lower annual license fee for passenger cars of low power.

The revised schedule of fees will become effective Dec. 15, when the 1933 license plates go on sale.

Four-cylinder cars will continue to pay a $7 license fee, but six-cylinder automobiles up to 28 h.p. S.A.E. rating will pay $12 as against $15 beyond this power. The fee for small eights will be $15 and for large eights $20. Fees for 12 and 16-cylinder cars will remain unchanged.

Fees for small commercial vehicles will not be changed, but there will be an upward trend for large trucks in keeping with the recommendations of the Royal Commission on Transportation, which recently presented its report to the Federal Government.

The truck scale has not yet been announced, but it is intimated that the new schedule will impose heavy levies on motor transports and coaches which compete with the railway systems.

Reduction in the Ontario fee for light eight-cylinder passenger cars will be an advantage to the owners of Ford eights which, this year, called for a license charge of $20, in addition to proving a boon for imported light cars. The general revision of the license tariffs does not mean reduced revenue for the Ontario Government. As a matter of fact, the province expects to secure increased revenue to the extent of $200,000 largely because of the heavier imposts on heavy trucks and buses.

Soviet Begins Payments

CHICAGO, Nov. 22—The soviet government has begun to make its 1932 payments on farm equipment shipped to that country in 1929, 1930 and 1931, according to local concerns.

The International Harvester Co. announced the receipt of between $4,000,000 and $5,000,000 as the final payment on its order of 1929 and partial payment on the order of 1931. A balance of approximately $2,500,000 is due the Harvester Company in the autumn of 1933.

Harold Sayre Wheeler

Harold Sayre Wheeler, a Detroit automobile engineer in the early days of the industry, died Nov. 19 in Pasadena, Calif.

Mr. Wheeler was educated at the University of Michigan. While a student he wrote automobile engine articles for *Horseless Age*, the first automotive publication, since merged with *Automotive Industries*. At 24 he became a consulting engineer with the Chalmers organization.

Seven years ago he established his home in Pasadena. Besides his widow. he leaves a son and daughter.

Cadillac Sales Show Big Gains

DETROIT, Nov. 22—Cadillac-LaSalle sales during the month of October ran far ahead of any previous month since last June, J. C. Chick, general sales manager, announced today.

Upsetting the usual tendency to slow up at this season, Cadillac forged ahead to an increase of 14.1 per cent over September, and showed a substantial margin over the preceding months of July and August.

"Our business has shown a consistent improvement during the past two months," said Mr. Chick, "and the fact that the last ten days of October showed the biggest increase during the month exceeding the last ten days of September by 23.5 per cent, indicates an upturn in general business conditions."

Bendix Stockholders Reduce Capital Stock

CHICAGO, Nov. 21—Stockholders of Bendix Aviation Corp., at a special meeting held in South Bend voted approval of a resolution reducing the corporation's capital to $10,488,315 from $52,441,575, accordingly reducing amount of capital represented by each share of issued stock to $5 from $25 and transferring $41,953,260 from capital stock account to capital surplus account.

Stockholders also approved plan to change shares of common stock without par value into shares of a par value of $5 each.

Lincoln Car Sales Up Again

DETROIT, Nov. 21—For the fourth consecutive month, retail sales of Lincoln motor cars are showing an increase over the previous month, the Lincoln Motor Co. reports.

Retail Lincoln sales in the first ten days of November showed a 54.7 per cent increase over retail sales in the first ten days of October.

Swift's Chevrolet Fleet Grows

DETROIT, MICH., Nov. 22—Swift & Co. bought more than 1000 new Chevrolet Six cars and trucks for the 12 months ending Oct. 1, bringing the Swift Chevrolet fleet to 2500 units.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

NEW YORK, Nov. 23—There was practically no change in general business last week, with activity mostly along seasonal lines.

There appears to be a tendency for business to await the war debt settlement and the budget legislation when Congress meets next month. Most speculative markets were quiet, although the downward trend in commodity markets was maintained.

Among the trades, textiles made the best showing, with shoe business next.

GUARANTY TRUST INDEX LEVEL

The Guaranty Trust Company's preliminary index of business activity for October stood at 58.0, as against 58.1 for September and 70.7 a year ago. The Company's index of wholesale commodity prices on Nov. 15 was 35.9, as against 36.5 a month earlier and 46.5 a year ago.

FREIGHT LOADINGS OFF

Railway freight loadings during the week ended Nov. 5 totaled 588,383 cars. As a result of seasonal influences, this total marks a decline of 29,259 cars below that during the preceding week. It also marks a reduction of 128,665 cars below that a year ago and a reduction of 293,134 cars below that two years ago.

N. Y. FACTORY EMPLOYMENT UP

The upturn in New York State factory employment reported in September continued during October. Whereas the usual seasonal upturn is only about 1 per cent, the increase last month amounted to 2.8 per cent. Total payrolls increased 3.0 per cent.

INSURANCE SALES DOWN

Sales of ordinary life insurance during October were 20 per cent below those a year ago. The reduction was experienced in every section of the country excepting Nevada and New Mexico, which reported increases for the month.

FISHER'S INDEX

Professor Fisher's index of wholesale commodity prices during the week ended Nov. 19 stood at 60.4, as against 60.3 the week before and 60.2 two weeks before.

BANK DEBITS DOWN

Bank debits to individual accounts outside of New York City during the week ended Nov. 16 were 35 per cent below those a year ago.

STOCKS DROP LOWER

Following the post-election rise during the preceding week, a downward trend occurred on the stock market last week. There were no new developments, and trading was very limited.

Speculation for a rise was dampened by the uncertainty attending the war debt settlement and the decline in sterling. Most issues closed the week with net losses.

FEDERAL RESERVE STATEMENT

The consolidated statement of the Federal Reserve banks for the week ended Nov. 16 showed a decrease of $4,000,000 in holdings of discounted bills, and an increase of $1,000,000 in holdings of bills bought in the open market. Holdings of Government securities remained unchanged.

The reserve ratio on Nov. 16 was 62.4 per cent, as against 62.4 per cent a week earlier and 62.1 per cent two weeks earlier.

Plan Ship-Plane Line to Cut Atlantic Time

Service from Ireland to Halifax Would Reduce Crossing by 36 Hours

LONDON (*Special*)—C. H. Clendining, chairman of the Transatlantic Corp., Ltd., announced here that preliminary investigations had been completed for a combined sea and airport scheme that would bring New York 36 hours nearer to London.

It is proposed to build a great deep-water harbor and airport on Galway Bay, West Ireland, and to run 30-knot liners to Halifax, Nova Scotia, the Transatlantic passage taking about three days.

Direct air services would then take passengers and mails to cities in Canada and the United States, and air service also would link London and the Continent with Galway Bay.

Rome and Moscow would be reached from New York in four days if the liners were timed to arrive in Galway Bay at dawn.

A few weeks ago an experimental service between Galway and Berlin was conducted jointly by one of the German shipping companies and the Royal Dutch air lines and was so successful that it was decided to run permanent service next year. London is about three and three-quarters hours flying from Galway.

Sir John Purser Griffiths, noted engineer, and Maxwell Ayrton, architect, it is stated, have submitted a favorable report to the governments of Canada and the Irish Free State and to the British Air Ministry. Sir Alan Cobham has been commissioned to design an airport on land to be reclaimed alongside the proposed pier.

For the past two summers the Pan-American Airways has been operating an airmail and passenger service between Boston and Halifax, N. S., via St. John's, Nfld., which would be the only link of the network of United States air lines to connect with the schedules outlined in the plane-ship-plane service from Ireland.

Autocar Gets Truck Order from Navy

PHILADELPHIA, Nov. 22—The Autocar Co., Ardmore, Pa., announces the receipt of an order for 32 of its new heavy-duty trucks from the United States Navy Department. The order comprises 23 Model DF and nine Model NF Autocars, both new models.

Autocar Company will make delivery to Naval Stations in this country and to stations in almost every foreign possession of the United States, including the Philippine Islands, Hawaiian Islands, Canal Zone, Puget Sound, Great Lakes Station in Illinois, League Island in Philadelphia, Pensacola, Florida, and Mountain View and Mare Island in California.

This is the second large order for Autocar trucks placed by the Navy Department within the past two years, and brings the total Autocar fleet in the service of the Navy up to 57 units. The company has sold 314 trucks to the Federal Government within the past two years.

Another important order, booked by Autocar within the past week, is the sale of 15 Model R trucks to Metropolitan Distributors, New York City.

Expects 24,158,000 Registrations in 1933

PHILADELPHIA, Nov. 23—Based on preliminary motor vehicle registration figures received from the Motor Vehicle Departments of twenty-four states, it is indicated that total registrations will be approximately 24,158,000 units, or 7 per cent less than the registrations of 1931.

Total registrations for 1931 were 25,976,748.

Motor Wheel Shows Loss

DETROIT, Nov. 22 — Motor Wheel Corp., Lansing, has reported a net loss of $839,419 after depreciation and all other charges, for nine months ended Sept. 30. This compares with a net loss during the same period last year of $37,706.

FWD Adopts 5-Day Week

CLINTONVILLE, WIS., Nov. 22—The Four Wheel Drive Auto Co. has adopted the five-day week as a part of the National Rehabilitation Program.

Durant Sale Again Postponed to Dec. 15

Chicago Firm Will Submit Bid, Says Receiver for Plant

LANSING, Nov. 21—Public sale of the Durant Motor Co. of Michigan was adjourned to December 15 when property was placed on auction block for third time here Thursday.

Byron L. Ballard, attorney for Central Trust Co., here, receivers, adjourned the sale when no bids were submitted. He announced that property had been inspected Monday and Tuesday by representatives of a large Chicago corporation, who announced their firm, which now operates 11 plants scattered throughout the country, would submit a bid for Durant property in December.

The Chicago firm, according to Ballard, manufactures a number of products and is closely connected with the automotive industry. He said it is their intention to secure the Durant plant, and centralize all operations in Lansing.

Milwaukee Electric Will Replace Barges With Trucks

MILWAUKEE, Nov. 22—Adoption of motor truck delivery of coal instead of by river barge to its two large steam generating plants in the downtown district of Milwaukee by the Milwaukee Electric Railway & Light Co. becomes effective Nov. 15, according to George G. Post, vice-president.

The change is prompted largely by the fact that the two barges in use for years will soon require replacement at heavy cost.

Delivery by motor truck will be accomplished at night to avoid interference wit already congested traffic.

Rubber-Shod Nag and Soft Tires Are Boon to Noise-Weary Nerves

The 1932 National Dairyman's Show at Detroit exhibited a horse-drawn milk-wagon on the new streamline Jumbo tires, intended for automobiles.

With rubber shoes for Dobbin and rubber-insulated milk containers, no one should be aroused in the wee small hours of the morning.

Good Show Calls for Encores in Toronto

Winter Fair, Nov. 16, May be Followed by National Exposition

TORONTO, Nov. 21—If Toronto likes anything better than a motor show it is another motor show. Following closely upon the heels of the automotive display at the Canadian National Exhibition in September was the automobile feature of the Royal Winter Fair at the Toronto Coliseum opening Nov. 16.

At the same time, arrangements are in hand for the National Mid-Winter Motor Show at the Automotive Palace in January under the direct auspices of the Canadian Automobile Chamber of Commerce.

The exhibits at the Royal Winter Fair comprised the Studebaker, Auburn, Hupmobile and Stutz while a special feature was Sir Henry Segrave's recording-breaking "Golden Arrow," which was shown by C. C. Wakefield and Company, Limited.

A.P.I. Elects Ames As 1933 President

Other Officers Reelected At 13th Annual Meeting

HOUSTON, Tex., Nov. 16 — C. B. Ames, of The Texas Co., New York, N. Y., was elected by the board of the American Petroleum Institute as president for 1933. He succeeds Amos L. Beaty, of New York, who was elected at the 1931 annual meeting. The other officers were reelected.

The board elected the following Executive Committee to serve during 1933: C. B. Ames, The Texas Co., New York; H. R. Gallagher, Consolidated Oil Corp., New York; Charles F. Roeser, Fort Worth; D. J. Moran, Continental Oil Co., Ponca City; W. T. Holliday, Standard Oil Co. (Ohio), Cleveland.

Axtell J. Byles, Tidewater Associated Oil Co., New York, N. Y., and Amos L. Beaty, New York, N. Y.; R. C. Holmes, The Texas Co., New York; F. A. Leovy, Gulf Production Co., Tulsa; J. Edgar Pew, Sun Oil Co., Philadelphia; E. G. Seubert, Standard Oil Co. (Indiana), Chicago; H. F. Sinclair, Consolidated Oil Corp., New York, and W. C. Teagle, Standard Oil Co. of New Jersey.

Ray Prescott Johnson, Sr.

Ray Prescott Johnson, Sr., 54, a founder of Warner Gear Co., prominent Muncie industrialist, died on Nov. 16 in Phoenix, Ariz., where he had been in a critical condition for two days.

A founder of the Warner company, whose consolidation with the Borg and Beck Company and the Marvel Carburetor Company was an important development in automotive manufacture a few years ago, Mr. Johnson was vice-president of the Borg-Warner Corp. He held the same office in the Glasscock Mfg. Co. and was president of the Warner Electric Co.

Mr. Johnson was forced because of his ill health, induced by a heart disorder, to go to Phoenix, Ariz., last fall.

Mr. Johnson was educated at a military school in Ohio and was graduated from the University of Chicago in 1903. He played football on the Chicago team coached by A. A. Stagg.

In 1903 Mr. Johnson went to Joplin, Mo., where he engaged in the mining industry for a short time. The automobile industry was then in its infancy, and that same year Mr. Johnson returned to Muncie to become one of the six employees of the newly founded Warner Gear Co. The Johnsons were associated with T. W. Warner and Warren Sample in the enterprise. He was an expert technician and gradually rose to the presidency of the company, which he assumed in 1919.

His expert knowledge of automobile mechanics was recognized during the World War when he was sent by Secretary of War Newton D. Baker to France to head a committee overseas in organizing repair shops for the A. E. F. Motor Transport.

A son, Ray Prescott, Jr., a graduate of Harvard and Wabash Colleges, now connected with the Borg-Warner Corporation in Chicago, and a daughter, Miss Margaret Johnson, at home, survive besides the widow and sister.

Truck Seat of Live Sponge Rubber

A newly designed truck seat of two-layer sponge rubber filler, covered with a two-thickness fabric slip cover, has been announced by the Sponge-Aire Seat Company of Buffalo, N. Y.

One of the advantages claimed for this sponge-rubber cushion is that it withstands hard daily service without sagging, packing down, or breaking out. The top layer is of very porous sponge rubber, so it fits the body perfectly and provides a soft seat; while the denser lower layer acts as a stabilizer, and prevents catapulting and side-sway.

Marmon Reports Smaller Loss

INDIANAPOLIS, Nov. 21—Marmon Motor Car Co. reported for the six months ended Aug. 21, a loss after depreciation and other charges of $485,695, against $900,466 loss in corresponding period last year.

For the quarter ended Aug. 31, the net loss after above charges was $259,650, against $227,045 loss in preceding quarter and $320,006 loss in quarter ended Aug. 31, 1931.

Erskine Sees 50% Increase in 1933

"Selling Must Regain Courage," Pierce-Arrow President Tells Salesmen

BUFFALO, Nov. 21—Addressing the Pierce-Arrow National Sales Convention Wednesday, Albert R. Erskine, chairman of the board of the Pierce-Arrow Co., predicted 50 per cent increase in automobile business next year.

"Selling must get its courage back," said Paul G. Hoffman, president of Studebaker Sales Corp.

Other addresses were delivered by these Pierce-Arrow officials: William M. Baldwin, director of advertising; Karl M. Wise, director of engineering; Roy H. Faulkner, vice-president in charge of sales, and Arthur J. Chanter, first vice-president and general manager.

Mr. Faulkner announced the appointment of David J. Willoughby, vice-president in charge of the New York City branch of Pierce-Arrow as general sales manager of the Pierce-Arrow Motor Car Co. Three hundred attended.

Canadian Railways Men See Economy in Trucks

OTTAWA, ONT., Nov. 22—Both the Canadian Pacific and the Canadian National Railways are prepared to meet the highway competition by entering truck transportation business and engaging particularly in hauls exceeding 50 or 60 miles.

Within these distances the truck and bus can operate most efficiently and profitably, President E. W. Beatty, of the Canadian Pacific Railway, and Gerald Ruel, former vice-president of the Canadian National Railways, told the Duff Commission.

Spokesmen of the truck and bus operators in statements made to the commission, made it clear that they were not opposed to rate regulation so long as it was effective "without being onerous."

Baltimore Show Plans Underway

BALTIMORE, Nov. 22—The show committee of the Automobile Trade Association, which sponsors the annual show in Baltimore, has been appointed.

The event will be held at the Fifth Regiment Armory, opening on Jan. 21 and closing on Jan. 28.

Stenning With Chrysler

C. B. Stenning, war pilot, has resigned from the MacLean Publishing Co., Toronto, to take charge of the advertising account of the Chrysler Motor Co. with the Walsh Advertising Agency, Windsor, Ont.

Credit Extension Will Speed Business Upturn

Milan Ayres Will Tell Dec. 6 Convention About "Depression Fallacies"

CHICAGO, Nov. 21—Liberal extension of credit to the American wage earner and salaried employe, with the consequent revival of consumption, will be among the topics uppermost for discussion when the National Association of Finance Companies opens its annual convention in New Orleans on Dec. 6.

The member firms of this organization which specialize in the purchase of instalment paper, are prepared to lead the way to business recovery by financing the sale of almost anything from radio sets to Diesel engines and from electric refrigerators to factory equipment.

"If post-depression experiences of other years are a criterion," said Milan V. Ayres, economic analyst of the association, today, "we shall presently find ourselves producing, selling, and consuming more goods of every description than ever before, and American standards of living will step up another notch."

Mr. Ayres, who will address the convention on "Depression Fallacies," will cite facts and figures to refute such statements as that the "orgy of instalment buying" involved the American people heavily in debt and brought on the present economic conditions.

He will show that the instalment system has been doing its full part toward sustaining business and that without its aid, America's retail sales volume would have been reduced by many millions of dollars with a corresponding cut in payrolls.

Maryland Finds Bad Brakes, Lights

BALTIMORE, Nov. 22—The first 100,000 motor cars inspected in the annual Save-a-Life campaign in Maryland show that fully 50 per cent of them were being operated with faulty headlights and more than 30 per cent with defective brakes, according to State Motor Vehicle Commissioner E. Austin Baughman.

The commissioner will refuse to issue licenses for 1933 for cars that are not inspected. He also is empowered under the law to keep the uninspected cars off the highways after December 1.

Federal Rubber Production Concentrated in Fisk Plant

MILWAUKEE, Nov. 22—Production at the Federal Rubber Co. plant in Cudahy, near here, is being suspended on Nov. 15 and transferred to the Fisk plant at Chicopee Falls, Mass.

Lon Smith With Cummins

Lon R. Smith

Lon R. Smith, veteran automotive executive, has been appointed special representative of the Cummins Engine Co., Columbus, Ind., by C. L. Cummins, president.

John Nivin is general manager of the company.

Allis-Chalmers Will Spend $203,000

MILWAUKEE, Nov. 22—Allis-Chalmers Mfg. Co. has announced an appropriation of $203,305 for plant improvement under the policy of the National Committee for Industrial Rehabilitation.

Of this sum $85,500 has been allocated for materials and labor, and $65,805 for tooling in the manufacture of 100 tractors of a new type, with super-balloon tires as standard equipment.

The line was revealed to the Milwaukee Section, S. A. E., at its November meeting, which was held at the Allis-Chalmers clubhouse, where a comprehensive exhibit was installed.

Gen. Otto H. Falk, formerly president and now chairman of the board of Allis-Chalmers, is serving as vice-chairman of the rehabilitation committee for the Wisconsin area.

I. H. C. Tooling Now Nears Completion

CHICAGO, Nov. 22—International Harvester Co. has practically completed the task of tooling for its new baby tractor and production is expected to get under way soon after the first of the year.

The company's decision to bring out a tractor in the $500 class reflects its intention to dominate the low-priced field where volume is unusually heavy.

The new units will undersell by approximately $150 the next lowest priced tractors, unless further adjustments are made by competitors in preparation for 1933 sales.

French Micron Car and British M. G. in Canada

Small Automobiles Appear and Plans for Production to Follow if Demand Grows

TORONTO, Nov. 21—The variety of available automobile models in Canada has been increased by the introduction of the British M.G. which is being sold through Empire Sports Cars, Ltd., and the French Micron, a midget car with front-wheel drive.

Four models of the M.G. are being shown, three of which are six-cylinder and one, a roadster, which is a four. The M.G. is the first British line to make its appearance in the Dominion under the new tariff preference.

The Micron is virtually a cyclecar with a one-cylinder motor, and it is listed to sell in Canada at $300.

If the product takes hold, arrangements will be made for its manufacture in the Dominion, it is stated.

Reo Sees Gain In Truck Sales

LANSING, Nov. 22—Officials of the Reo Motor Car Co. are looking forward to a large truck business after the first of the year.

The past 30 days have brought to the sales division many letters from large corporations which appear to be in the market for fleets of trucks.

According to Harry Teel, plant manager, old transportation is rapidly wearing out, but the business will come to the Reo and other truck builders after the first of the year when these corporations make up their 1933 budgets.

De Xavier Represents Salerni Transmission

The Salerni transmission, which consists of a "fluid flywheel," a conventional change-speed gear and a Salerni coupling, is being demonstrated in Detroit by J. de Xavier. A feature of the Salerni fluid flywheel is that the drive can be entirely interrupted by means of an internal valve, operated by a pedal on the toe-board, which prevents the circulation of the fluid inside the flywheel.

Continued motion of the pedal opens the Salerni coupling at the rear of the transmission. The latter is then disconnected from both the engine and the rear axle and gear-shifting can be effected without difficulty.

Date and Place Are Set For Chicago Dealers' Meet

The Sixteenth Annual Convention and Banquet of the National Automobile Dealers' Association, January 30 and 31, will be held in the Medinah Athletic Club, Chicago.

Auto Steel Demand Is Rising to Peak

Mills Report Volume Gains Despite Drop in Non-Automotive Orders

NEW YORK, Nov. 23—Recent gains in the rate at which steel is going into automotive consumption are well maintained, in sharp contrast with the demand from steel buyers in other lines most of whom are virtually out of the market.

Flat steel releases for body and fender stock have made it possible for rolling mills in the Cleveland district to attain a rate of operations that is not only the highest since spring, but also one that would be considered fair in more normal years for late November.

As a result steel-making operations in the Cleveland district are now estimated to be between 35 and 40 per cent on an ingot basis or about twice what is generally estimated for all steel producing districts taken as a whole.

Youngstown and Chicago district mills enjoy a fair share of automotive steel demand. Activity in the Detroit district continues unchanged. Pittsburgh district mills, however, are not getting as much of the automotive business sa they would like to have.

Chevrolet and Plymouth releases continue to come in for most of the trade comment, but orders for material for Buick bodies are attaining more and more importance from day to day.

Pig Iron—Buying by automotive foundries is mostly along narrow routine lines. There is nothing in the situation to cause melters to contract further ahead than for their nearby requirements. Prices are unchanged.

Aluminum—Quiet but somewhat better demand for piston metal is noted. Prices remain as heretofore.

Copper—Secrecy is maintained regarding the discussions among producers under way. The market is quotable at 5⅜c, delivered Connecticut Valley points.

Tin—Lower sterling exchange rates caused prompt Straits tin to be offered early this week at 23.35c.

Lead—The leading interest lowered its contract price $2 per ton to 3c, New York, at which price level the market is steady.

Zinc—Unchanged and quiet.

Baltimore Abandons Sales Tax Proposal

BALTIMORE, Nov. 22—Mayor Howard W. Jackson, of Baltimore, who made an effort to have a retail sales tax imposed in Baltimore as a means of raising funds for the operation of the city government next year, has given up the idea.

The plan met with strong opposition on the part of automotive dealers.

Robert M. Cutting

Robert Myron Cutting, 50, president of the R. M. Cutting Co., makers of motor trucks, and an executive of the United States Golf Association, died suddenly of a heart attack Nov. 20.

His wife, Mrs. Mary Bartelme Cutting, holder of a number of women's golf titles, was with him when he died. They made their home at the Hinsdale Golf Club.

He was a star baseball player in his student days at the University of Michigan.

His rise in the golf world dates back to 1924, when as an official from the home club in charge of the Western Golf Association's annual championship over the Hinsdale course, he won a place on the association's board as secretary.

U. S. Increases Duty On Parts From Canada

Countervailing Raised In Retaliation to Canadian Schedules of Ottawa Pact

WASHINGTON, Nov. 23—The Bureau of Customs has applied countervailing duties on motor vehicles, parts and accessories imported from Canada in retaliation for the increased Canadian duties placed on these products when imported from the United States.

The higher Canadian duties were made effective as the result of the British Imperial Conference in Ottawa. Under the agreement of British Empire units preferential rates on products from British sources were widened, while rates applying to the United States and other countries were increased.

The Hawley-Smoot act requires that duties on motor vehicles, parts and accessories, coal and lumber be raised to a level equal to that applied by other countries on similar products when imported from the United States.

Charles E. Miller

Charles E. Miller, pioneer manufacturer and distributor of parts and accessories, with headquarters for many years in New York City, died recently at his home in New Rochelle, N. Y., at the age of 66 years. Mr. Miller retired from active participation in automotive distribution of accessories in 1922 but continued his interest in philanthropic work.

Mr. Miller was widely known among the builders of the automotive industry to which he came, as many others did, from the bicycle business. He is survived by his widow, the former Alfreda Thaanun, and a brother, Richard, of Orange, N. J.

Dresel to Command Macon

Commander Alger H. Dresel, now in charge of the U. S. Navy airship Akron, will command the Macon, sister ship of the Akron, now under construction here by the Goodyear Zeppelin Corp.

Reorganization or Loss, Is Kelsey-Hayes Plight

President Kennedy Tells Stockholders That Expansion Program Could Not be Funded

NEW YORK, Nov. 23—G. W. Kennedy, president of Kelsey-Hayes Wheel Corp., in a letter to stockholders, proposed a plan of reorganization because "the financial position of the company had become increasingly precarious since Dec. 31, 1931."

Failure to adjust the company's indebtedness and capital structure, the latter pointed out, "will precipitate involuntary readjustment which may, and probably will, result in the total loss to the stockholders of their investment and present equities."

A plan for reorganization, approved by the directors and outlined in the letter, provides for $1,567,800 additional funds and converting liabilities totaling more than $11,000,000, about one-half into fifteen-year obligations and one-half into capital stock. All creditors, whose claims would be refunded and holders of substantial amounts of stock, have assented to the plan.

A new company is to be formed to acquire the assets of the present corporation and to assume or refund all of its indebtedness.

The principal creditors will accept obligations of the new company maturing in fifteen years for $5,500,000, approximately one-half of the aggregate amount due them. These obligations will consist of $2,000,000 of fifteen-year first mortgage 8 per cent bonds and $3,500,000 of fifteen-year convertible 6 per cent debentures. In payment for the remaining amount due them they will receive 221,345 shares of Class A stock of the new company, of which 290,285 shares will be outstanding. A like number of Class B shares also will be outstanding.

"The major portion of this indebtedness resulted from the expansion program of the corporation, which has placed the corporation in its position as a principal source of supply in the motor industry.

"Due to the decline in the securities market and to the curtailment in the automotive industry, it has not been possible, as originally contemplated, to fund these obligations through the sale of either bonds or additional capital shares of the corporation.

"In addition, as a result of the factors above mentioned, the corporation is under the immediate necessity of raising not less than $1,500,000 of additional working capital."

The reorganzation committee consists of Henry S. Bowers of Goldman, Sachs & Co.; Herbert L. Chittenden, Harry S. Covington, William H. Ducharme, A. C. Falconer, H. Gardner Jackson, J. T. Leimert and Edward J. Quintal.

Master Tire Buys Quaker City Plant

Ohio Concern Adds Philadelphia Unit; Assets Reach $5,000,000

AKRON, Nov. 22—The Master Tire & Rubber Corp. with offices in Cuyahoga Falls, Ohio, has acquired the plant and all assets of the Quaker City Rubber Co. of Philadelphia.

The Quaker plant makes hose, belting, gaskets, etc. Its acquisition puts the Master tire company in the mechanical goods field as well as the tire business.

The Master concern was formed in 1930 with the merger of smaller rubber companies, including the Falls Tire & Rubber Co. of Cuyahoga Falls, and the Giant Tire & Rubber Co. and the Cooper corporation both at Findlay, Ohio, besides the new Quaker plant.

Acquisition of the Philadelphia plant gives Master assets of $5,000,000; annual sales of $6,000,000, and a total of 1200 employees, according to W. P. Cline, vice-president and treasurer of the organization.

F. C. Millhoff, vice-president of the Master corporation and executive head of the Falls plant, will direct sales reorganization of the new unit.

R. P. Bremer is president of the Master corporation; I. J. Cooper, chairman of the board; W. P. Cline, vice-president and treasurer; J. F. Schafer, secretary, and F. M. Shadley, comptroller.

All units of the corporation have been operating on a profitable basis for the last two years, officials of the company report.

Gutchess Returns From Europe

Allen D. Gutchess, president DeVilbiss Co., returned recently from a month's business trip to Europe. He visited the company's branches in England and France.

Business in England during 1932 compared favorably with 1931, owing to the strenuous campaign to "Buy British," he said.

Benet Promoted by Worthington

Hugh Benet has been named manager of the Harrison (N. J.) works of Worthington Pump & Machinery Corp.

Since 1927, when Mr. Benet became associated with the Worthington organization, he has served as manager of the corporation's Holyoke (Mass.) Works.

Invents "Electric Oar" To Propel Small Boats

SYRACUSE, Nov. 22—A new propelling equipment for light boats, known as the "electric oar," has been developed by Charles P. Grimes here. It comprises an oar of the usual type which is swivel-mounted on a clamp that is secured to the stern of the boat.

The oar swivels on the clamp in such a way that it can be moved from side to side for steering and also lowered into the water or raised out of it. Mounted on the oar near its handle is a small electric motor, and near the opposite end, a propeller, and motor and propeller are connected together through a shaft.

The motor is operated through a 6-volt automobile battery. A single switch provides two speeds, 1.9 to 2 m.p.h. for trolling, and 3.8 to 4 m.p.h. for general use.

Attached to a 16-ft. round-bottom fishing boat, the motor draws 6.6 amps. for trolling and 24 amps. for general use.

It is claimed that a 19-plate 61-lb. automobile battery will troll 21 hours and propel the boat at the higher speed for 5 hours. The new equipment, no doubt, will be welcomed by the battery industry as opening a new outlet for its product.

Automobile Financing Shows Nearly 50% Decrease Compared With 1931

Monthly statistics on automobile financing, based on data reported to the Bureau of the Census by 320 automobile financing organizations, are presented in the table below. These figures include complete revisions.

Year and Month	Wholesale Financing Volume in Dollars	RETAIL FINANCING											
		TOTAL			NEW CARS			USED CARS			UNCLASSIFIED		
		Number of Cars	Volume and Average		Number of Cars	Volume and Average		Number of Cars	Volume and Average		Number of Cars	Volume and Average	
			Total Amount	Per Car		Total Amount	Per Car		Total Amount	Per Car		Total Amount	Per Car
1930													
September	$45,310,662	218,849	$90,218,740	$412	92,061	$52,807,904	$574	121,476	$35,199,971	$290	5,312	$2,210,865	$416
Total (9 Mos.)	$559,917,923	2,414,062	$994,079,851	$412	1,092,890	$617,663,311	$565	1,245,778	$346,588,037	$278	75,394	$29,828,503	$396
Total (Year)	$660,978,901	2,933,973	$1,201,341,267	$409	1,287,796	$730,417,562	$567	1,558,932	$435,989,399	$280	87,245	$34,934,306	$400
1931													
January	$40,164,672	160,490	$61,691,837	$384	58,499	$32,945,588	$563	97,834	$27,236,324	$278	4,157	$1,509,925	$363
February	49,812,959	172,958	66,130,134	382	67,599	36,854,428	545	100,696	27,707,242	275	4,663	1,568,464	336
March	63,089,716	237,273	91,997,270	388	102,665	55,022,086	536	128,311	34,688,428	270	6,297	2,286,756	363
April	71,194,343	290,076	112,982,254	389	133,347	70,544,761	529	149,112	39,546,288	265	7,617	2,891,205	380
May	72,623,199	277,950	109,372,143	393	126,729	68,564,134	541	142,796	37,781,543	265	8,425	3,026,466	359
June	58,171,936	265,389	104,642,284	394	115,106	63,554,955	552	141,935	37,988,162	268	8,348	3,099,167	371
July	48,853,330	236,878	95,910,307	405	100,832	59,300,107	588	128,707	34,126,071	265	7,339	2,484,129	338
August	43,942,549	204,878	79,598,201	389	83,602	46,865,947	561	115,020	30,486,513	265	6,256	2,245,741	359
September	35,840,571	176,663	68,284,838	387	67,609	38,609,797	571	103,234	27,580,567	267	5,820	2,094,474	360
Total (9 Mos.)	$483,693,275	2,022,555	$790,609,268	$391	855,988	472,261,803	552	1,107,645	$297,141,138	$268	58,922	$21,206,327	$360
October	25,770,269	159,980	60,691,614	379	58,055	33,195,759	572	97,437	25,882,006	266	4,488	1,613,849	360
November	15,719,974	131,047	48,568,648	371	44,701	25,394,801	568	82,816	21,891,123	264	3,530	1,282,724	363
December	29,257,137	134,663	50,432,428	375	48,131	27,305,927	567	82,757	21,859,828	264	3,775	1,266,673	336
Total (Year)	$554,440,655	2,448,245	$950,301,958	$388	1,006,875	$558,158,290	$554	1,370,655	$366,774,095	$268	70,715	$25,369,573	$359
1932													
January	$34,841,766	122,344	$44,628,529	$365	41,375	$23,475,671	$567	77,321	$19,974,286	$258	3,648	$1,178,572	$323
February	33,276,393	123,574	44,829,138	363	40,780	23,623,496	579	78,802	19,941,665	253	3,992	1,263,977	317
March	34,121,364	140,779	51,148,285	363	46,234	26,887,515	582	90,121	22,779,892	253	4,424	1,480,878	335
April	33,903,704	155,691	56,415,652	362	57,661	31,835,792	552	93,398	23,066,269	247	4,632	1,513,591	327
May	38,608,439	164,721	58,435,573	355	63,885	33,590,555	526	96,010	23,257,953	242	4,826	1,587,065	329
June	43,682,471	177,961	63,169,095	355	74,205	38,329,334	517	99,513	23,394,676	235	4,243	1,445,085	341
July	26,016,028	132,467	44,716,907	338	45,816	24,149,326	527	82,687	19,225,478	233	3,964	1,342,103	339
August*	22,104,084	131,069	45,068,741	344	46,416	24,644,532	531	80,648	18,908,584	234	4,005	1,515,625	378
September**	18,701,129	(a)111,286	38,853,440	349	39,548	21,567,010	545	67,791	15,991,033	236	3,947	1,295,397	328
Total (9 Mos.)	$285,255,378	1,259,892	$447,265,360	$355	455,920	$248,103,231	$544	766,291	$186,539,836	$243	37,681	$12,622,293	$335

* Revised.
** Preliminary.
(a) Of this number 35.54 per cent were new cars, 60.91 per cent used cars, and 3.55 per cent unclassified.

Rubber-Covered Valves Offered by Goodyear

AKRON, OHIO, Nov. 22—Rubber-covered valves for automobile tire tubes are a new product of the Goodyear Tire & Rubber Co. These valves are vulcanized to the tubes and employ no locknuts, which latter, on the clamped-in model of valve, are apt to work loose and to start air leakage around the base.

In case of puncture, the rubber-tired valve will slip back into the tire without tearing the tube, which is not true of metal valves with rim nuts. Standard metal-valve insides are used in the construction of the new rubber-covered tube valve. The valve is an integral part of the tube. It fits into the rim hole under compression, providing a water-tight seal.

While primarily developed for use on drop-center-type rims, which latter are in use on most cars of recent manufacture, tubes with the new rubber-covered valve can be used also on many types of flat-base rims.

Canadian July Gas Sales Show Gain

OTTAWA, ONT., Nov. 22—Sales of gasoline in Canada during July increased 0.13 per cent to 51,331,174 gallons from the June total of 51,174,322 gallons, but declined 23.2 per cent from the July, 1931, sales of 66,795,000 gallons.

Ontario sales were 22,037,000 gallons; Quebec, 10,591,000; British Columbia, 4,117,000; Alberta, 3,926,000; Saskatchewan, 3,451,000; Manitoba, 2,915,000; Nova Scotia, 2,275,000; New Brunswick, 1,662,000; Prince Edward Island, 357,000.

William S. Brock

William S. Brock, one of aviation's old guard, died Nov. 13 in Chicago of cancer. The flier, who with Edward F. Schlee of Detroit, once crossed the Atlantic on an attempted around-the world flight, had been bedridden for four months. He was 36 years old.

Born in Gladstone, Ohio, Brock took up aviation when he was 16 years old. Two years later he was an Army instructor at Ellington Field, Texas.

After the war Brock embarked on a colorful career of airplane barnstorming. He bought a used Army plane and started out to bring aviation to the tank towns.

In 1927 he became associated with Mr. Schlee. They planned a world flight and on Aug. 27 left Harbor Grace, N. F., in the Stinson monoplane, Pride of Detroit.

They made the 2350-mile hop to Croydon Airdrome, London, without a mishap. From Croydon their progress across Europe was a series of rousing receptions. They stopped in Munich, Belgrade and Contantinople. There the Turkish authorities presented difficulties but the pair were delayed only a day.

From Constantinople they flew to Bagdad, then to Bunder Abbas, Persia; to Karachi, India; to Allahabad, India; to Calcutta, India, and thence to Rangoon, Burma. From Rangoon they flew to Hongkong.

"Master" Salesmen Get Studebaker Checks

SOUTH BEND, Nov. 22—Hundreds of members of the Studebaker retail selling organization throughout the nation who qualified for the Studebaker "master salesman's" club, launched last January, are now receiving bonus checks from the Studebaker Sales Corp. of America.

A letter signed by Paul G. Hoffman, president of the sales corporation, accompanies each check. Its closing paragraph reads as follows:

"Studebaker has made substantial progress in its way out of the depression in 1932. You have contributed toward that progress. We intend to really go places in 1933."

Sharer is Sales Executive

George M. Sharer has been appointed sales manager of Link-Belt's eastern division, with headquarters in Philadelphia. In this capacity, he has direct supervision of sales of all offices in the Atlantic Coast States.

Champion Introduces Heavy Duty Plugs

TOLEDO, Nov. 22—Champion Spark Plug Co. has brought out two new spark plugs for use in bus and truck engines, the No. 35 Commercial in the ⅞-in. line and the No. 10 in the 18-mm. metric line.

Spark plugs in this service must be able to stand a lot of oil and great heat, the latter being due to the high average load factor.

The cores of these spark plugs, which are seated high in the shells, are said to be maintained at a sufficiently high temperature to keep clean, while the restricted bore of the firing end limits the direct action of the heat on the core, thus assuring a maximum range.

Hudson Dealer Stocks Decrease Sharply

DETROIT, Nov. 21—With Hudson and Essex retail sales exceeding shipments in a ratio of almost 2 to 1, dealer stocks on hand decreased sharply during October, C. G. Abbott, general sales manager of the Hudson Motor Car Co., said.

The position of Hudson has improved steadily ever since the introduction of the Terraplane last July. There has been an actual increase of sales for the three months ending November 1, 1932.

+ + CALENDAR OF COMING EVENTS + +

FOREIGN SHOWS

Paris, Aeronautical Show...Nov. 18-Dec. 4
Berlin International .....Feb. 12-22

CONVENTIONS

National Standard Parts Association, Detroit .....Dec. 2-10
International Booster Clubs, Detroit .....Dec. 4
Motor & Equipment Wholesalers' Association, Detroit .Dec. 5-7
American Society Mechanical Engineers, New York City (Annual Meeting) .....Dec. 5-9
Natl. Exposition of Power & Mechanical Engineering, New York .....Dec. 5-10
Natl. Automotive Parts Assoc...Dec. 12-14
Rubber Mfr.'s Assoc., New York City, Annual Meeting .....Jan. 9
Annual Society of Automotive Engineers Dinner—New York..Jan. 12
Highway & Building Congress, Detroit .....Jan. 16-20
American Road Builders' Annual, Detroit .....Jan. 16-20
Steel Founders Soc. of America—Annual Meeting—Detroit...Jan. 16-21
Annual Society of Automotive Engineers Meeting — Detroit Jan. 23-26
American Soc. for Testing Materials (Annual Meeting)...June 26-30

SHOWS

Joint M.E.M.A., M.E.W.A. and N.S.P.A. Trade Show, Detroit .....Dec. 5-10
National Automobile Show, New York .....Jan. 7-14
Pacific Automobile Show, San Francisco .....Jan. 7-14
Los Angeles, Calif., Automobile Show .....Jan. 7-15
St. Louis, Mo., Automobile Show.Jan. 8-14
Buffalo, N. Y., Automobile Show Jan. 14-21
Cleveland, Ohio, Automobile Show Jan. 14-21
Newark, N. J., Automobile Show Jan. 14-21
Cincinnati, Ohio, Automobile Show .....Jan. 15-21
Philadelphia, Pa., Automobile Show .....Jan. 16-21
Baltimore, Md., Automobile Show Jan. 21-28
Detroit, Mich., Automobile Show, Jan. 21-28
Boston, Mass., Automobile Show Jan. 21-28
Hartford, Conn., Automobile Show Jan. 21-28
Harrisburg, Penna., Automobile Show .....Jan. 25-28
Rochester, N. Y., Automobile Show .....Jan. 23-28
Washington, D. C., Automobile Show .....Jan. 28-Feb. 5
National Automobile Show, Chicago .....Jan. 28-Feb. 4
Springfield, Mass., Automobile Show .....Jan. 30-Feb. 4
Indianapolis, Ind., Automobile Show .....Feb. 4-11
Denver, Colo., Automobile Show Feb. 6-11
Springfield, Ill., Automobile Show Feb. 9-11
Kansas City Automobile Show..Feb. 11-18
Des Moines, Iowa, Automobile Show .....Feb. 27-Mar. 4
Seattle, Wash., Automobile Show Feb. 26-Mar. 4

State Highway Officials Seek Uniform Code For Statutes, to Aid Motor Transport Growth

Speakers Hit Attempts to Divert Gasoline Tax Revenues from Road Building Programs; as Secretaries Chapin, Hyde, and Wilbur Meet with Federal and State Highway Officials

By L. W. MOFFETT

WASHINGTON, Nov. 24—Reflecting views expressed by government officials and other speakers who addressed its meetings here Nov. 14-18, the American Association of State Highway Officials adopted a long list of reports and resolutions looking to more satisfactory and uniform laws governing highway transportation, taxes, etc.

One report urged a uniform motor vehicle code covering physical measurements of vehicles, and a resolution recommended removal of the limitation to $15,000 per mile on Federal contributions toward construction of Federal-aid roads and of restrictions on Federal aid for highways within municipalities. These restrictions were declared to be proving "a serious detriment to the orderly development of the Federal-aid highway system."

Secretary of Commerce Roy D. Chapin, former chairman of the Hudson Motor Car Co., advocated complete reciprocity between the states in the use of highways, adjustment of automobile taxes to conform with depleted incomes and the conservation of special taxes paid for highways "solely for that use." His speech, "The Obligations and Rights of Road Users," is published in part on pages 667 and 668 of this issue.

Warns Against Overconstruction

Secretary of Agriculture Arthur M. Hyde cautioned against road building beyond revenue and against jeopardizing investments already made. He also pointed out that the major road system is yet far from completion and that there is need for the improvement of tremendous mileages of secondary or rural roads. He warned that there is grave danger of repeating in state highway affairs what has happened almost universally in the counties, the extension of new construction beyond the income.

The piling up of state taxes on gasoline was condemned by the Secretary who pointed out that in some states they are producing the "inevitable reaction of diminishing returns and growth of bootlegging of gasoline."

Secretary of the Interior Ray Lyman Wilbur, speaking on the relationship of the highway with the national park system, suggested that state highway commissioners give consideration to a defined park-to-park highway system having certain requirements regarding the subject of outdoor advertising and beauty of the horizon.

Thomas H. MacDonald, Chief of the Bureau of Public Roads, proposed that the highway system be developed with a view to needs of the distant future. The uniform motor vehicle code resolution was based partially on recommendations for such a code made by Mr. MacDonald in an address to the Society of Automotive Engineers in Toronto.

Dangers of diverting revenues from gasoline and license revenue, sounded at the meeting, were warned against in a resolution which declared that at the coming sessions of State Legislatures there will be made "strenuous efforts to divert gasoline tax and motor license revenue from highways."

Hits Tax Diversion

It was stated that any such diversion "would reduce highway construction programs and as a result would decrease the demand for labor and the products of industry, thus making even more acute the present unfavorable economic conditions." The resolution declared that these possible diversions would entirely nullify the principle on which motor taxes have been based, and that the motorist should receive, in return for the taxes he pays, a system of improved highway facilities.

Other resolutions urged that the Federal government continue for two years its Federal-aid road appropriation of $125,000,000, which expires at the end of the present fiscal year; proposed repayment by the states of the advances made to them for emergency relief purposes by the Reconstruction Finance Corporation, rather than deduction of the amounts advanced from road appropriations in future years, the alternative method of payment; and pledged cooperation of state highway departments in making immediately effective any program of unemployment relief through road construction which may be adopted by the Federal government.

Rail-Truck Fight is Slump By-Product

"All of the available facts point to the conclusion that it is the present subnormal condition of business which is producing uncertainty as to the ultimate degree of competition between the railroads and motor trucks," said Secretary Hyde.

"With reasonable regulation of the motor carrier as to the standards of sizes and weights for trucks necessary for the protection of our highways and guarding the safety of operation of all highway traffic, there is ground for hope that the return of normal business will allay much of the fear that the motor truck can be a large factor in infringing upon the profitable business of commodity movement by the railroads.

"In the problems which now arise through the marginal competition between the railroads and highways, the fact of the necessity of highway building, as such, must be disassociated from the limited use which is competitive. Proposals to impose higher taxes upon motor vehicles, particularly motor trucks, as a means of limiting competition with the railroads must be carefully scrutinized in the light of their inevitable principal use for the purposes of feeding to, and distributing from, the railroads, the goods hauled by the railroads."

Quarter Billion Will be Diverted

Warning against diversion of automobile and gasoline tax revenue to other use than road construction and maintenance was sounded by Frederic E. Everett, Commissioner of Highways of New Hampshire, and President of the American Association of State Highway Officials. About $250,000,000 of such revenues will be diverted to other uses this year, Mr. Everett said.

He said that this amount consists of about $100,000,000 of such revenues received by the states and about $150,000,000 collected by the Federal government from the gasoline and oil taxes.

Repayment of funds advanced to the states by the Federal government for road construction as soon as possible without waiting for deduction of these amounts from Federal-aid road allotments was urged by Mr. Everett, so that the road construction program can go ahead without curtailment arising from deductions.

It was pointed out that deductions would begin automatically in 1935 under the present law through a provision made by Congress for repayment.

Mr. MacDonald made reference to the rapid progress made in road building.

Chicago Pneumatic Loss is $256,918

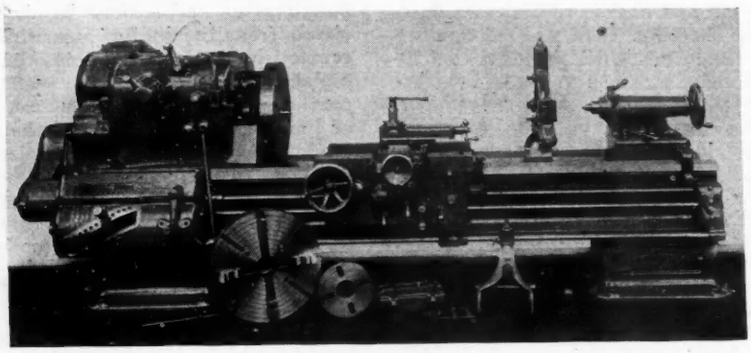
CHICAGO, Nov. 21—Chicago Pneumatic Tool Co. reports net loss of $256,918 for the September quarter. This compares with loss of $196,094 in the preceding quarter and loss of $170,554 in the same period last year.

NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

Springfield 24 in. Engine Lathe

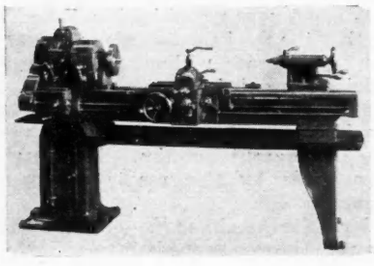
Twelve changes of speed in the headstock; 36 changes of threads and feeds in the gear box, are features of the 24 in. engine lathe just placed on the market by The Springfield Machine Tool Co., Springfield, Ohio. Improvements have been incorporated in the apron, including a centralized lubricating system reaching all bearing points. This machine with a 12 ft. bed weighs 11,450 lb.



LeBlond Super Regal Engine Lathe

A simplified engine lathe recently placed on the market by The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, at popular price embodies many new features for safe, simple control and automatic lubrication.

In addition to eight selective speed changes, the feed reverse and feed compounding gears are inside the head, thus eliminating noisy, troublesome tumbler gears and swinging plates on the end of the lathe.



All controls centralized—feed box; speed changes; feed reverse; feed compound; motor—are within easy reach of the left-hand of the operator without moving from his working position.

Improved Motor Mounting—Motor is mounted on a hinged plate on the rear of the leg. Its position requires no extra floor space and is high enough to be free of floor dust and eliminates any tendency to headstock vibration. The drive is by vee-belts.

The Super Regal is built in sizes 12 in. and 14 in. with any bed length required.

G-M Laboratories Photoelectric Relay

A new, low-cost photoelectric relay, the Foto-Switch, for experimental, industrial and scientific use, is announced by G-M Laboratories, Inc., 1735 Belmont Ave., Chicago. This unit embodies an electro-magnetic switch which is opened or closed by the interruption or variation in the illumination on the photoelectric cell. With the Foto-Switch, electrical devices, such as motors, electric signs, signals, or alarms, can be controlled.

In the field of display advertising, many novel arrangements of the Foto-Switch may be made. Window displays or window lighting may be automatically controlled by persons passing the show windows. Outdoor electrical advertising displays can be made to turn on or off by the passage of motorists or pedestrians.

Photoelectric equipment is used in manufacturing operations for counting and sorting the various parts in process. It is also used in the measurement of headlight characteristics and the distribution and range of the projected beam.

Flosol Cream

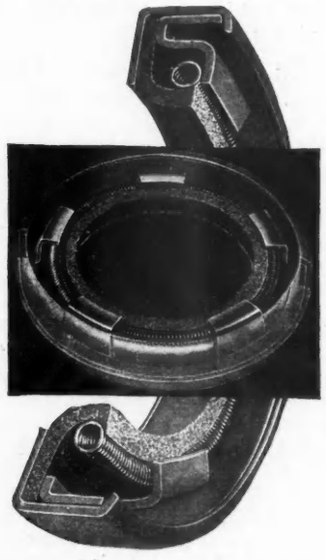
A new type of soldering flux known as "Flosol Cream" has been developed by the American Chemical Paint Co., Ambler, Pa. It is a white, creamy chemical, shipped in standard 12 lb. cans and 60 lb. pails, that is brushed on the metal to be soldered, like a paint. The coating dries in from 10 to 15 minutes and the flux covered surface can be tinned and soldered either before or after the coating dries.

This new flux was designed for soldering sheet steel, where the prevention of rust is of vital importance. Without sacrificing its valuable properties for steel soldering, it is said to flux perfectly most of the commonly used metals except aluminum and its alloys.

The nature of this flux is such that a thin film is applied to the metal surface that is to be soldered, and it remains there; for the film neither runs like an "acid," nor spreads when heated like a "paste." The little residue that remains after soldering is confined to a restricted area from which it can be removed easily with a wet cloth or with Deoxidine to prevent the metal rusting.

National Oil Seal

National Motor Bearing Co., Inc., San Francisco, Calif., announces a new oil seal for original and replacement use on automotive and industrial equipment. The new product, which consists of a metal case, helical spring in tension, and leather seal, takes its name "National Spider-Grip oil seal"



from five lugs which lock both leather and spring in place, and are claimed to maintain a perfect, permanent seal. The inner wall, integral with the lugs, is a press-fit into the outer wall, which is integral with the base, forming a double-wall case to increase the rigidity and permit driving to a tight fit without danger of distortion.

Welded Aircraft Structures Discussed

(Continued from page 669)

"A very common application of welding in aircraft is in the construction of fuel and oil tanks. Aluminum was adopted for these tanks on account of its lightness, and welding was adopted for the simple reason that it was the only reasonably satisfactory method of making joints in this material. The corrosive effect of the flux used in welding aluminum and its alloys forced a rigid method of cleaning in hot water, nitric acid solution, and a final rinse in fresh running water. Shop practice in the manufacture of these tanks is now so standardized that it is difficult to recall that the problem involved considerable experimentation. This was solved practically in the shop by building many tanks, using slightly different types of beads in the vicinity of the welds, and by varying widely the position of the beads.

"The use of welding in aircraft is now being challenged seriously * * * by the introduction of metals that lose most of their desirable qualities when subjected to heat sufficient to effect fusion. Aluminum alloyed with copper produces materials of construction that are comparable to mild steel in strength and are only one-third as heavy. This material has been welded in our shop, but very little can be claimed for the process, because the heat of welding seriously affects the shape of the parts, greatly increases its susceptibility to corrosion, and reduces its strength by approximately one half.

"The introduction of chrome molybdenum steel, with its air-hardening properties, its easy weldability, and its superior cold-form-fusion welding of steel in aircraft. The normalized material welded, such as is used in all steel tubular fuselage construction, is capable of 75,000 lb. p. sq. in. in tension and when heat treated for fittings will go as high as 200,000 lb. p. sq. in.

"Another serious challenge to the use of welding is the introduction of stainless steel. The heat of the welding operation greatly reduces the corrosion-resisting property of this material, and, for the Navy, where exposure to salt-corrosion conditions is a most serious problem, this quality is of paramount importance.

"Materials, processes, and the design of aircraft will be ever changing, in the attempt to decrease weight and increase safety and strength. The welding process has played a major role in the development of aircraft up to the present time, and even greater and more difficult problems and conquests are in the offing for the future."

James W. Cottrell, technical editor of *Commercial Car Journal*, presented a paper on "Maintenance of Bus and Motor Truck Equipment." In introducing Mr. Cottrell the chairman said that in arranging the program the Papers Committee had hesitated for a long time before it decided to include a paper on trucks and buses among those scheduled for the transportation session. Mr. Cottrell some time ago made an extensive survey of the use of welding in the repair shops of fleet owners and independent service stations throughout the country, and gave details of numerous uses of welding in these shops.

Another paper of automotive interest was by J. J. Fiechter, works manager of the Heintz Manufacturing Co., Philadelphia, the title being "Sales Advantages of Welded Products." Mr. Fiechter dealt with the application of welding in the manufacture of automobile bodies. He said welding made it possible to simplify the design, to cut down the time required for getting into production after the final designs had been released, to reduce the cost of tools, jigs and fixtures, and to improve the appearance of the finished product. From the standpoint of durability the welded construction has great advantages over that assembled by means of bolts, for it is essentially a one-piece structure and can never loosen or fall apart. Without welding it would be an utter impossibility to produce and sell at present prices automobile bodies built up of sheet metal parts.

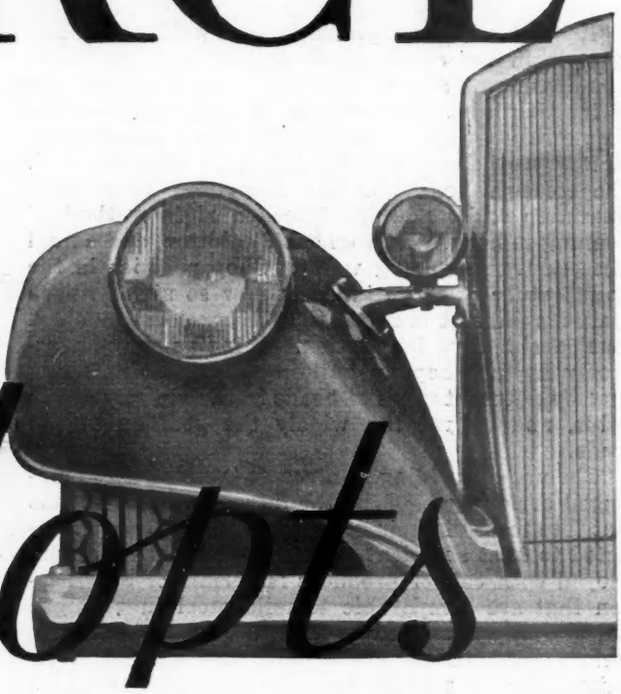
An important feature of welding is in connection with the construction of jigs and fixtures. In many cases it is possible to use ordinary steel plate with blocks which are placed around a wooden frame or template, which can be properly located without the necessity of the mechanic making a lot of measurements in order to obtain accuracy.

At the afternoon session on Friday two papers on methods of testing welds were presented, Dr. Ancel St. John of the St. John X-Ray Corporation, New York, reading a paper on "X-Ray Testing of Welds," and Dr. Gilbert E. Doan of Lehigh University, a paper on "Gamma-Ray Testing." Dr. St. John said that the first X-ray testing on welded joints was made by him in 1920 while he was associated with the Union Carbide Corporation, the tests being made upon coupons welded with acytelene. It took ten years before industry could be convinced of the merits of the process, but in 1930 the Babcock & Wilcox Company, after first having tests made on two welded test plates, 2¼ in. thick, with welds 48 in. long, commissioned him to design and install a plant for routine inspection of boiler drums at its Barberton plant. Before the end of the year an epoch-making revision had been made in the Boiler Code of the A. S. M. E., and as a result, X-ray-inspected fusion welds had come into use.

From Dr. Doan's paper and the discussion it appeared that the general principle of the gamma-ray test is the same as that of the X-ray test, both giving shadow pictures produced on a sensitive plate or film located behind the test object. Gamma rays are radiations of the same general character as X-rays, but of shorter wave length, and are emitted by radium.

An interesting feature of the convention was the presentation, on the evening of the opening day, of "The Prosperity Process," described as an industrial drama in three acts, by talent from within the Association. The whole story of oxy-acetylene welding was skillfully woven into the "drama," which had for its background the depressed state of activity and inclination of many to let their equipment go to seed.

PIERCE-



Adopts

STEWART POWER

Twelve months of the most rigorous road and laboratory tests convinced Pierce-Arrow engineers that here were the brakes to give Pierce-Arrow owners the utmost in safety, dependability and driving ease.

Stewart-Warner is justly proud of this tribute to its own engineering staff.

For today—as for more than three decades—Pierce-Arrow engineering is recognized for its exacting standards and progressive conservatism. Unproved fads—even though they give promise of enjoying a tremendous sales appeal—cannot successfully run the gauntlet of Pierce-Arrow engineers.

STEWART-WARNER MECHANICAL POWER